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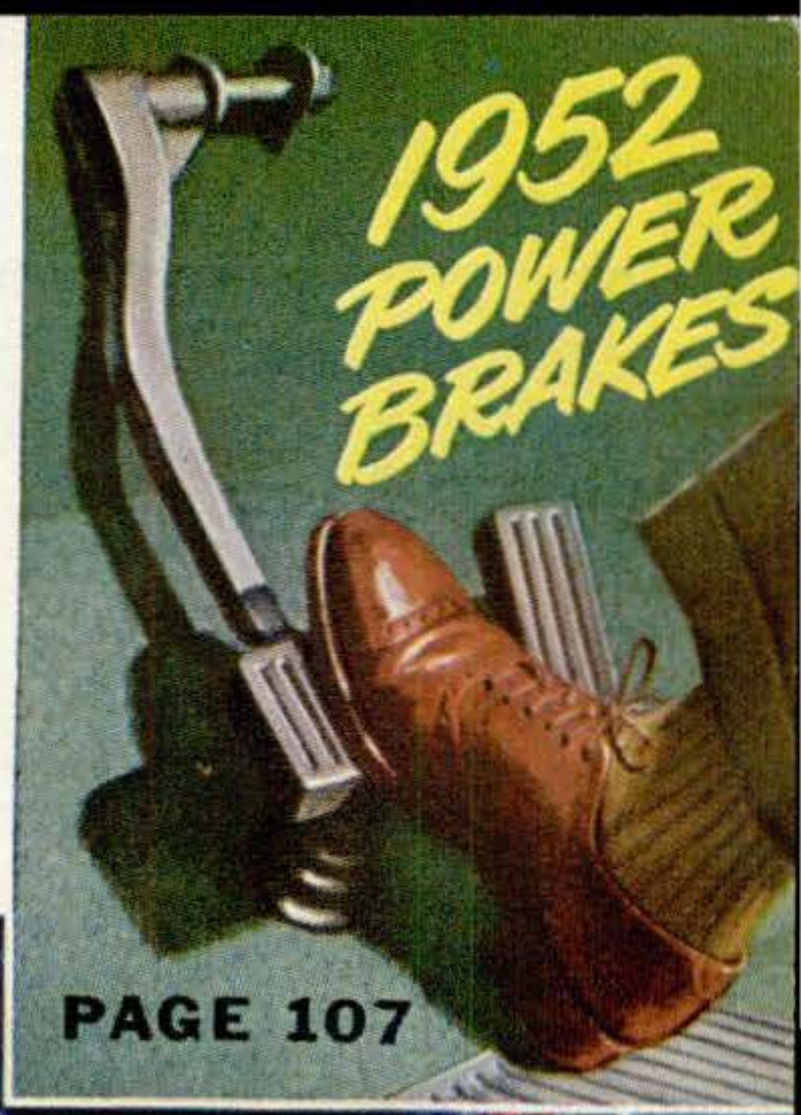

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Atoms Date Bible

By measuring atomic energy stored up at the time of Christ, scientists have verified this parchment scroll as the oldest known Bible manuscript. For the story of how they did it, see page 98.

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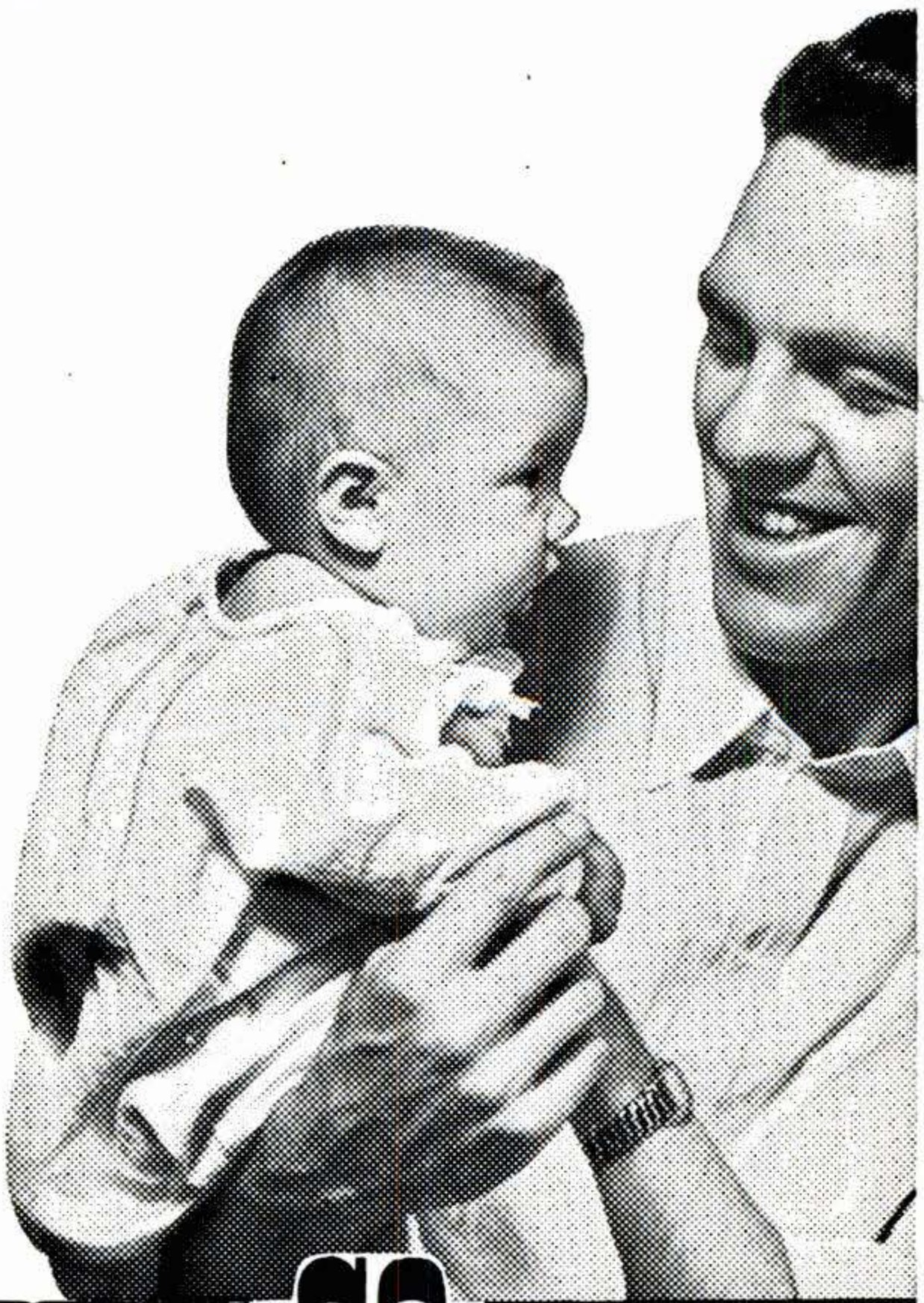

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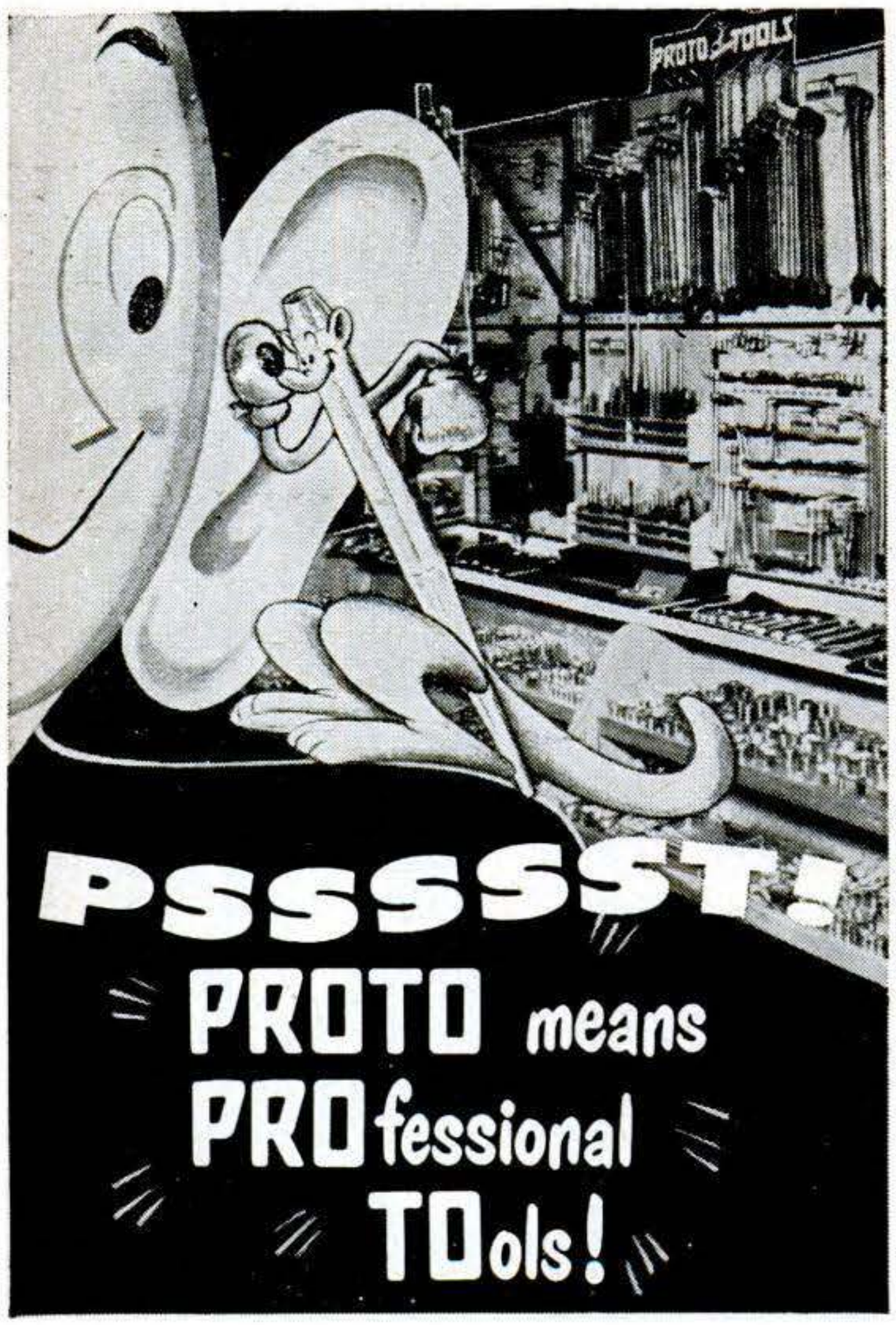

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NEXT MONTH:

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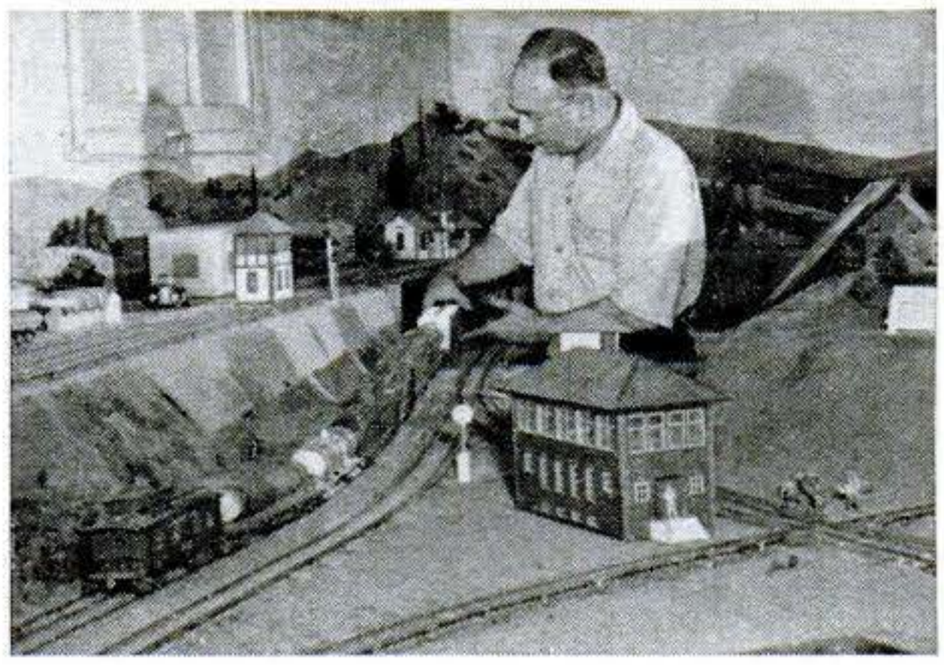

This impressive scale layout grew from a set of toy tinplate trains. In an article in the January issue, its owner tells how to start your own model railroad with what you already have, how to get the track up off the floor, and how to improve the system on a fun-as-you-go basis.

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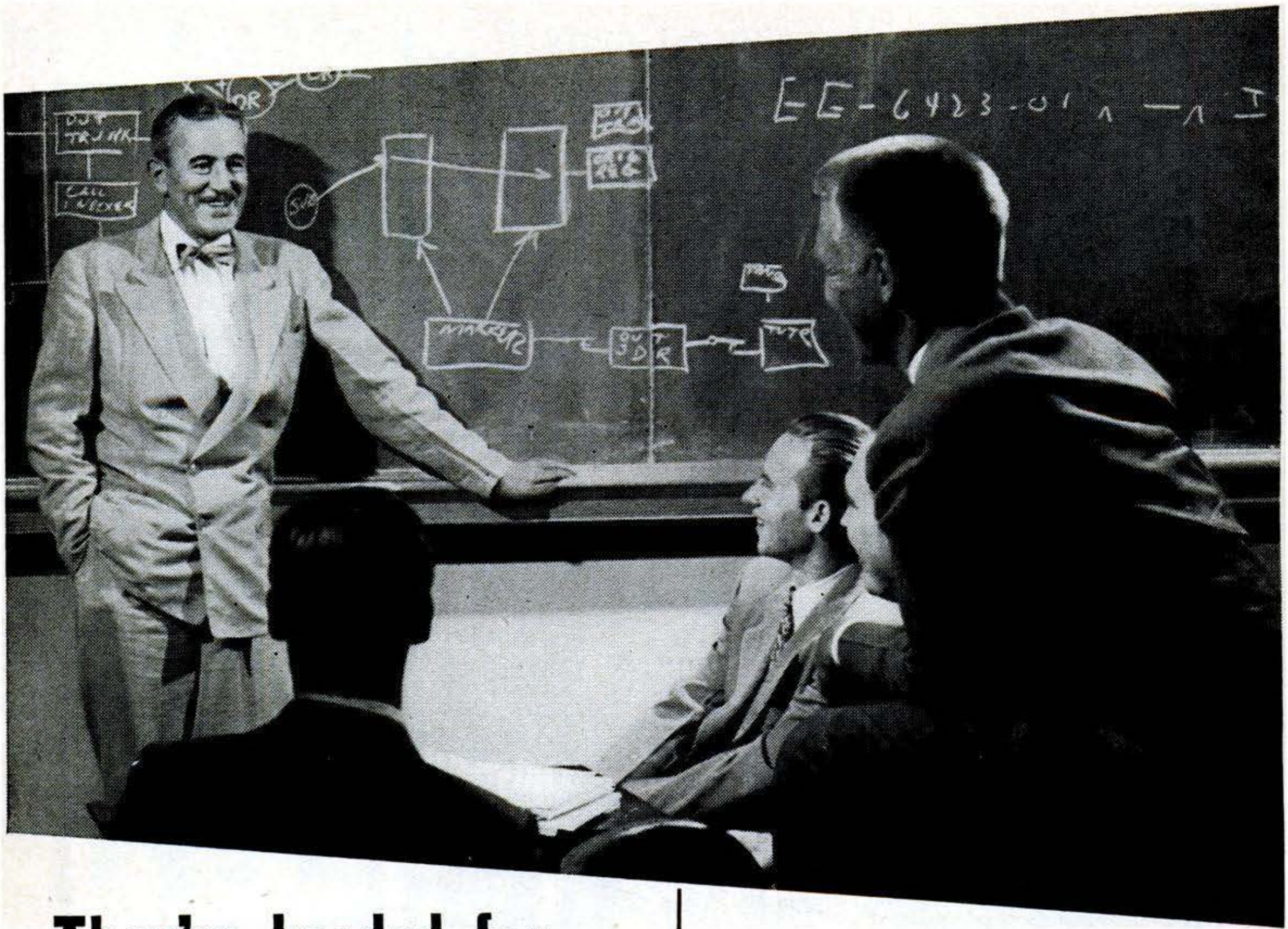

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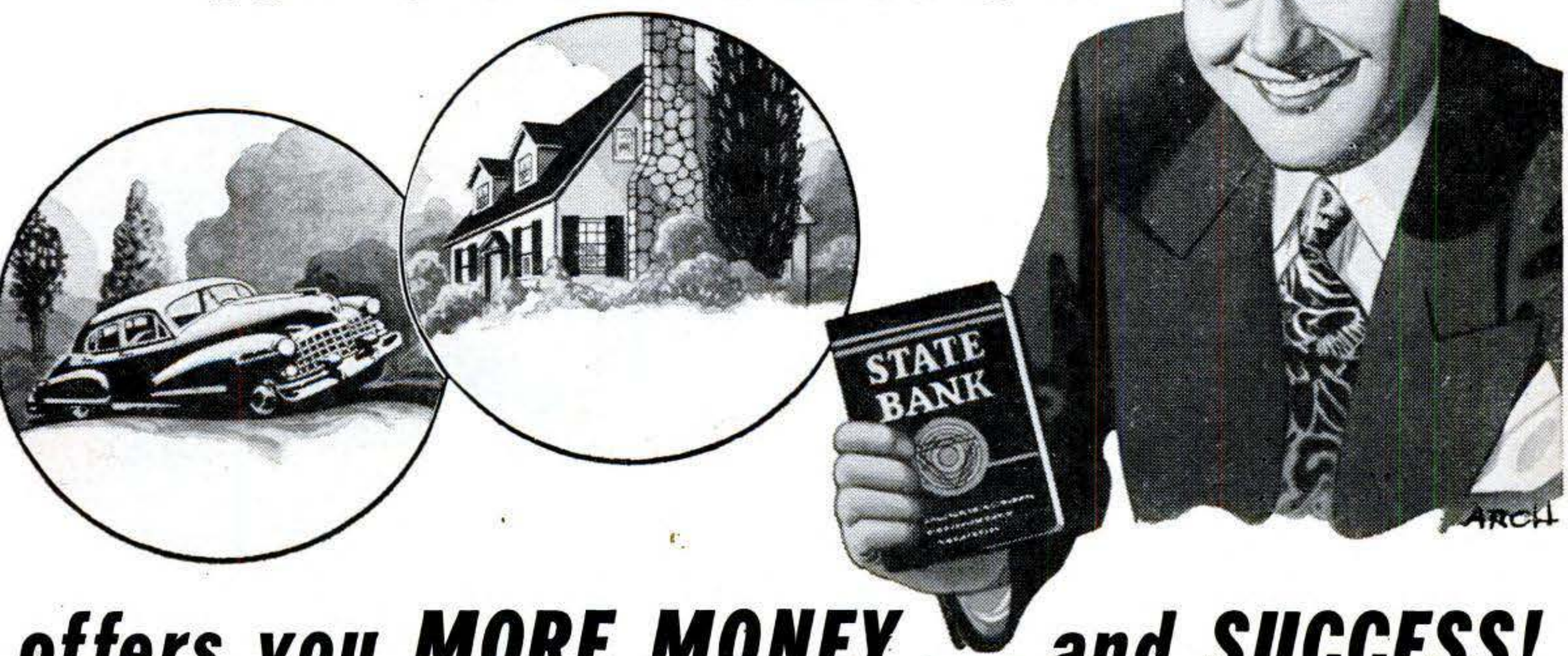

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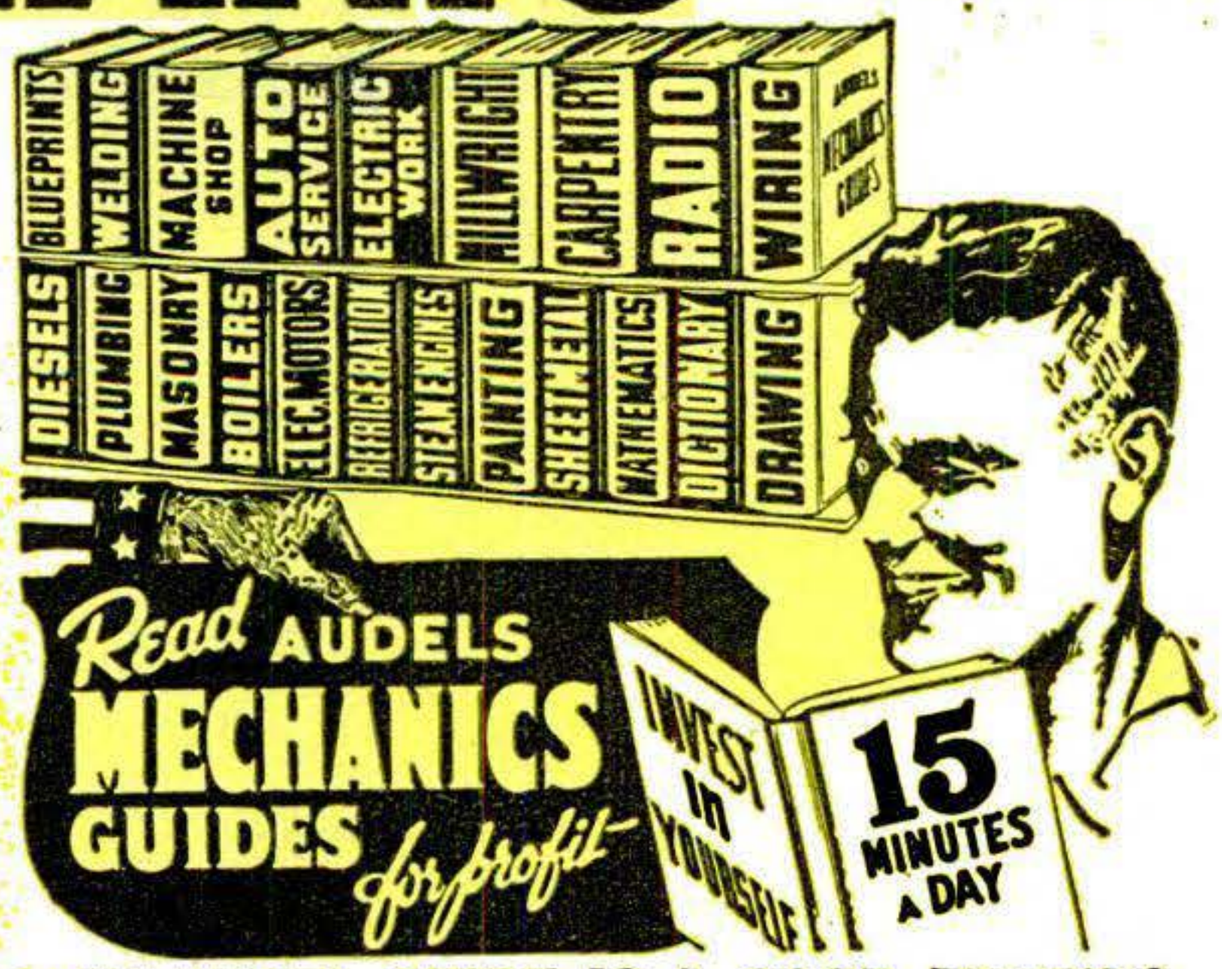

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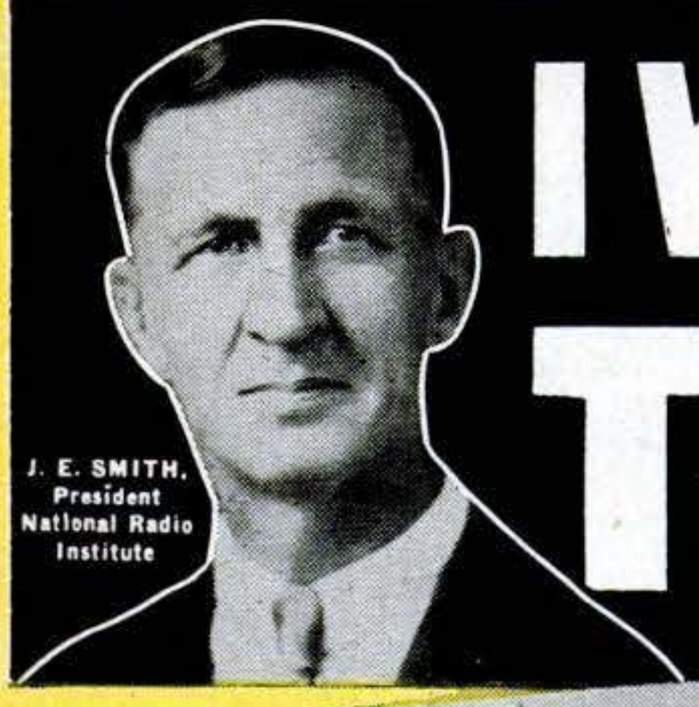

J. E. SMITH, President National Radio Institute

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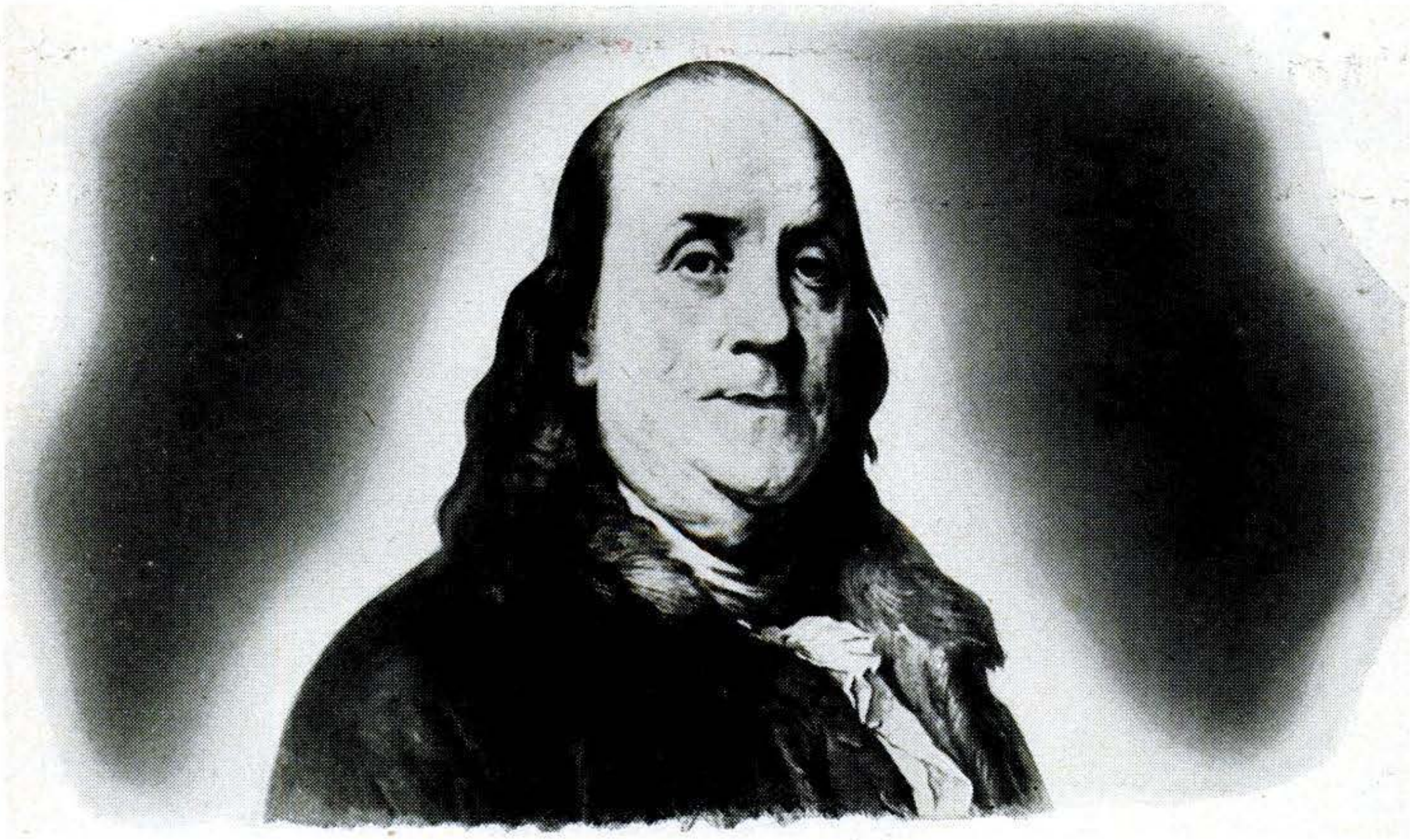

Benjamin Franklin
(A Rosicrucian)

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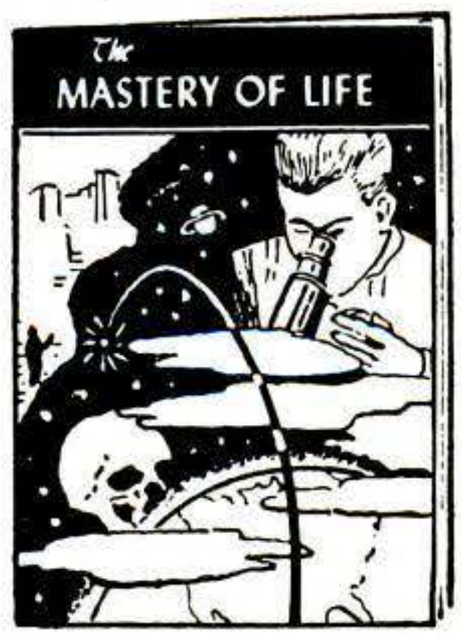

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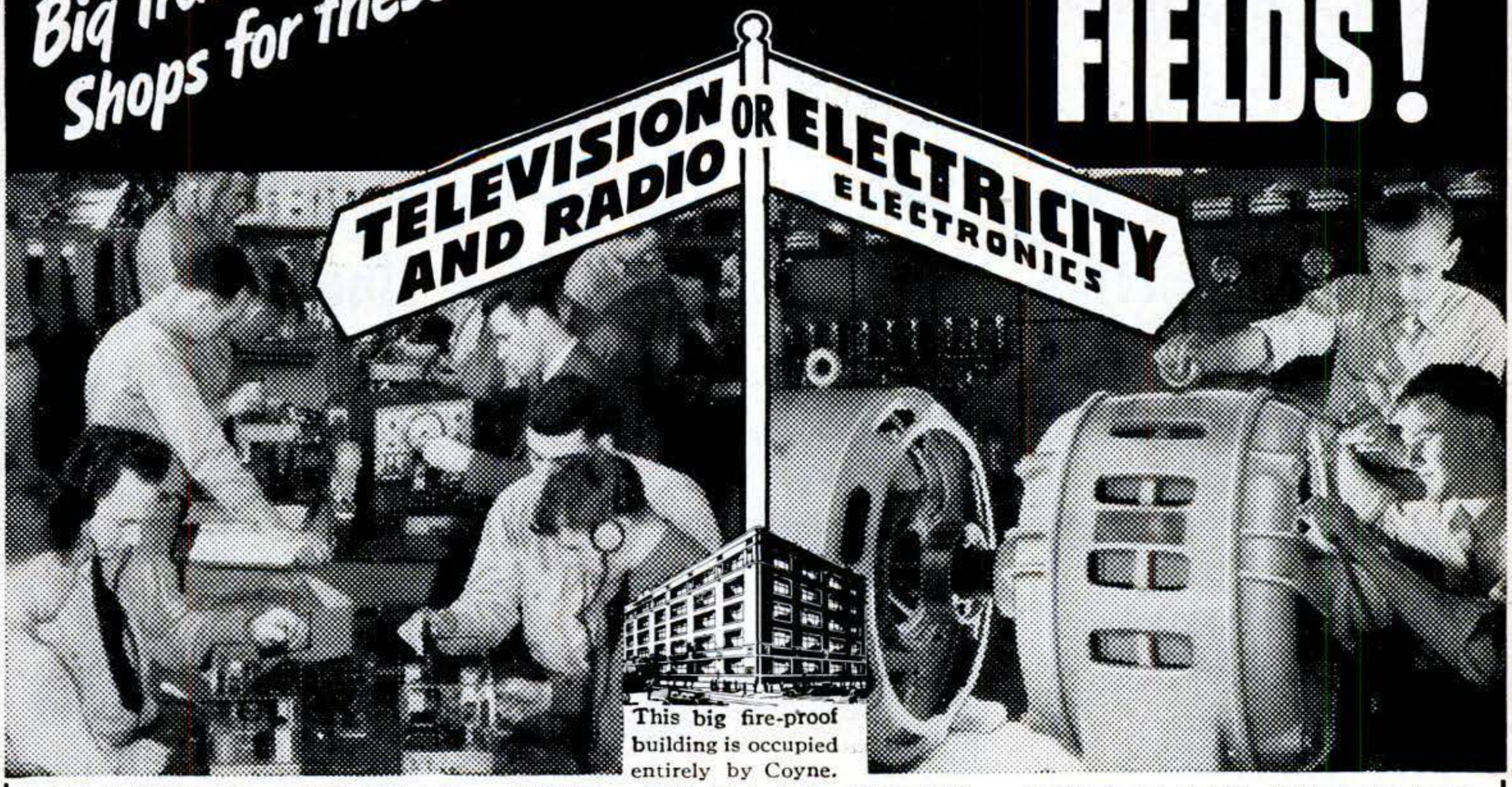

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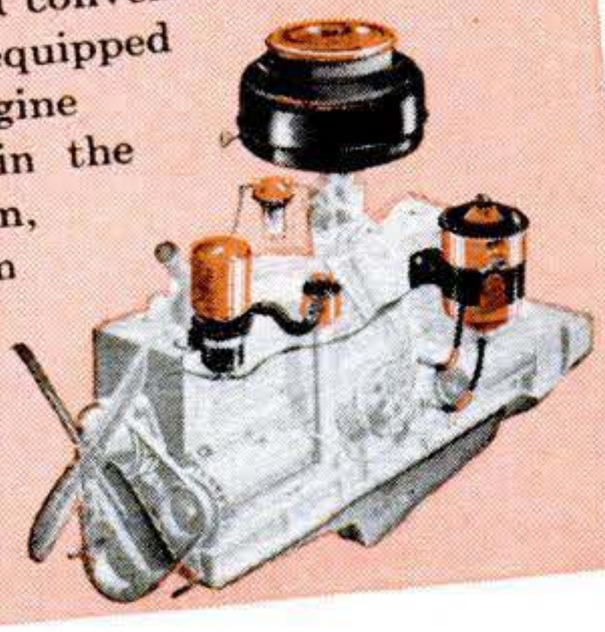

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Letters

Why Rockets Rocket

Since outer space contains no air, I can't understand how space ships are going to propel themselves through it by rocket thrust. What are these rockets going to thrust *against?*

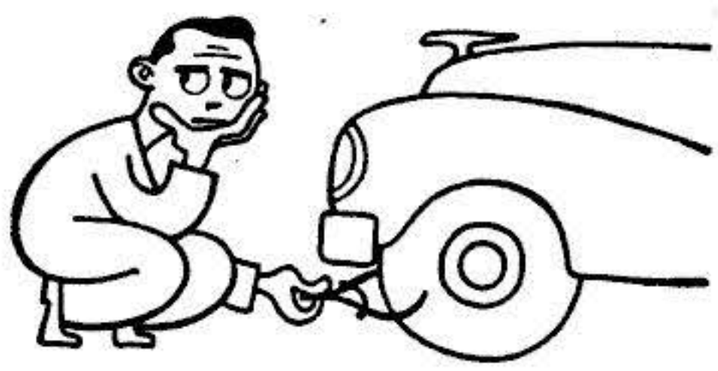
FRED R. ISENHART, Mt. Morris, Ill.

Rockets don't push against anything. They work in accordance with Sir Isaac Newton's Third Law of Motion: "For every action there is an equal and opposite reaction." Rockets force gas out the back; the reaction to this force sends the rocket forward. The most common example of such a reaction is the recoil of a gun.

A more unusual example is used by M.I.T. professors in a riddle they spring on freshmen: If you were marooned on the middle of a frozen pond, and the ice were completely frictionless, how would you get off? Answer: Spit. Reaction to the force of spitting would send you sliding backwards to shore.

How Big Are Tires?

Just for the heck of it, I put a big pair of calipers to a 6.50-16 tire the other day. Imagine my surprise when the calipers



showed a cross-section diameter much greater than 6.50 inches. Could the tire have been mis-marked?

JOHN SIKORSKY, Chicago

The section diameter of most tires is a little more than the designated size: 6.50 actually measures 6.8 in. In the new low-pressure tires, however, size designation is a true indication of section diameter.

Celestial Water Shortage

Your story about the "giant doughnut" proposed as a space station [Oct., p. 120] is all very interesting—but I am up in the air, too, about one thing: Since there is no atmosphere up there to draw moisture from, what happens when all the water in the station's turbine boiler is used up?

DAN RUBIN, Woodside, N.Y.

Dr. Wernher von Braun's plans for the rotating space station include a "radiation condenser" to turn the used steam back into water. Thus the boiler would use the same water over and over. What little was lost could be replaced by new shipments from the earth via rocket.

Wrong-Way Weather Vane

In a recent POPULAR SCIENCE you carried an article about a weather vane on top of a TV antenna. It's a good idea to leave off the compass directions if you have a rotatable antenna. Rotating the antenna would throw someone off course.

Down here we get two stations in Boston and one in Providence, R. I., and to get really good reception you need this kind of antenna.

ALBERT G. BROCK, Nantucket, Mass.

Stove Leads Double Life

In a recent issue Reginald Galbraith of Chicago said that he would "like to see them make" an electric range with some top burners for bottled gas.

I'd like to go him one further. A Majestic Two-Fuel, Single Oven Electric Combination Range cooks and bakes with either one of two fuels or both. This range is available in various fuel combinations: gas and coal-wood; gas and oil; electric and coal-wood; electric and oil.

RALPH E. SCHULENBURG, St. Louis, Mo.

Station-Wagon Repair

What kind of wood is the frame of my 1949 Mercury station wagon and how should I repair it?

ARLO L. CHATFIELD, McArthur, Ohio

The wood is maple. Cut away the rotted parts and glue in carefully fitted new maple. Fill all joints with plastic composition wood. Sand new and adjacent wood with increasingly finer grades of paper, down to 220 for

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If you believe that you have an invention, you should find out how to protect it. The first step is to have a search made of the prior pertinent U. S. patents. If a report on this search indicates that the invention appears patentable you can apply for a patent, and the specifications and claims should be prepared.

The firm of McMorrow, Berman & Davidson, with offices in Washington, D. C., is qualified to take the necessary steps for you. We can make a preliminary search on your invention, advise you whether we think it can be patented, and prepare your application for patent.

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RAZOR and BLADES

the final rubbing. Stain new wood with a mixture of raw sienna and enamel reducer, rubbed on and off until it matches. Finally apply three coats of spar varnish.

Rugged Arresters

How can I tell whether a lightning arrester is working properly after years of exposure? The bolts are corroded . . .

E. H. SWARTLEY, Alpine, Tenn.

Underwriters Laboratories says it would cost far more to test an individual arrester than to buy a new one. Very high voltages are needed for a proper test on most types.

If an arrester is cracked or broken, you should replace it. But approved arresters are made and tested for long service out of doors, so age alone needn't worry you. Neither should corrosion on the outside of the terminals.

Maserati Muffed

Your article on Italian cars in September [p. 138] was wonderful, and I would like to see more pages devoted to foreign makes. However, the auto pictured under the Ferrari caption is not a Ferrari but a Maserati, with convertible body by Frau.

MORTY RUBINGED, Montreal, Quebec

You have sharp eyes. This error was the result of misinformation in the original picture-agency caption.

Any Massachusetts Micromidgets?

I was quite interested in your article last August on building a one-lung racer. Here in Korea we are just holding on and waiting to get back among the benzine and alcohol fumes. My home is in Massachusetts. If any of your readers in that state are interested in micromidget racing, I would like to get in touch with them so we can get things rolling as soon as I get back.

ELMER P. PAYNE, Cpl.
AFRS Det., 8214th AU,
APO 301, c/o Postmaster,
San Francisco, Calif.

Thank You Kindly, Sir

After reading through your Letters department for several months, I have decided that yours is the most polite of the science and mechanics magazines when it comes to answering the gripes sent in by readers.

EDWARD DALE, Chicago

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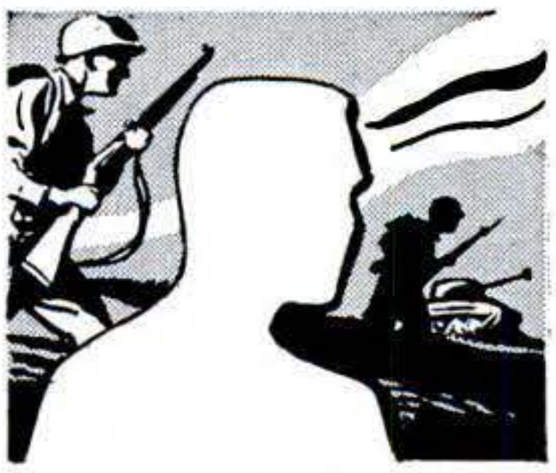
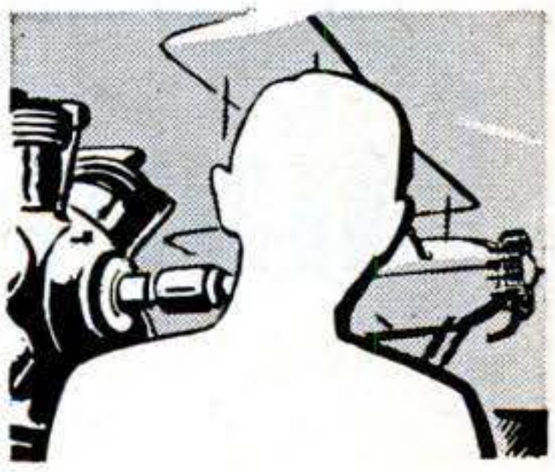
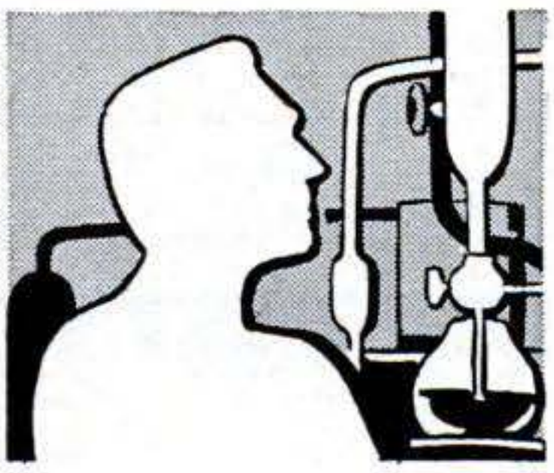


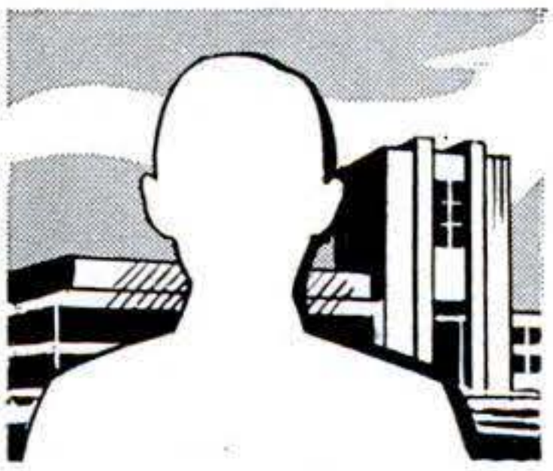
INVENTOR of a well-known U. S. Army rifle.



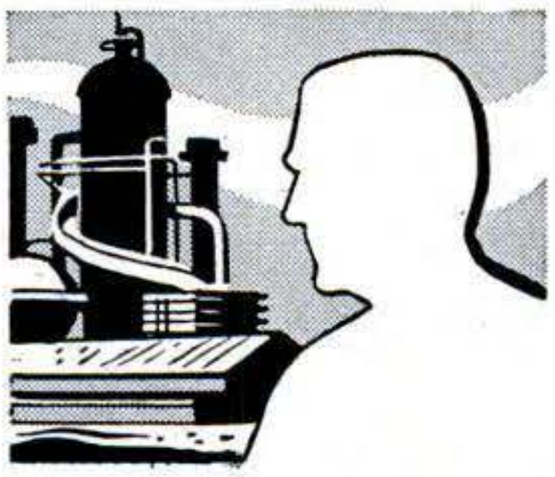
DESIGNER of a famous aircraft engine.



CHEMICAL director of nationally known research laboratory.



ENGINEER in charge of a famous company's engineering laboratory.



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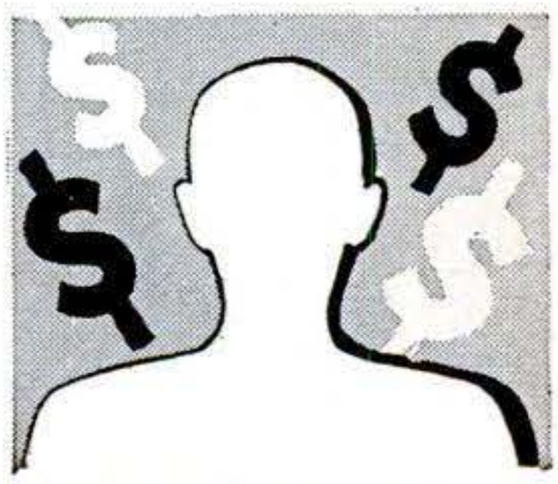

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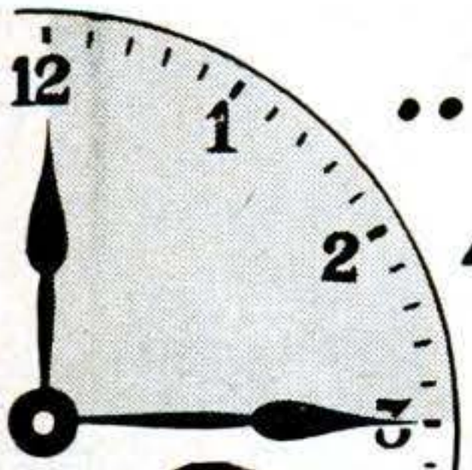
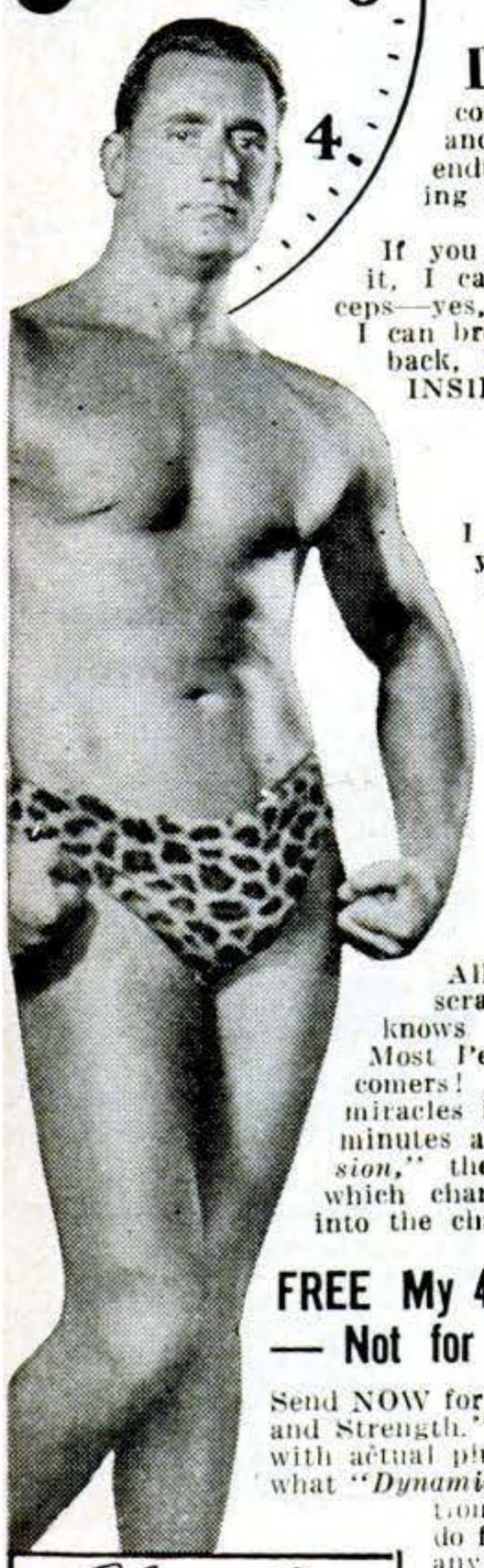


..and I'll prove I can make you a NEW MAN



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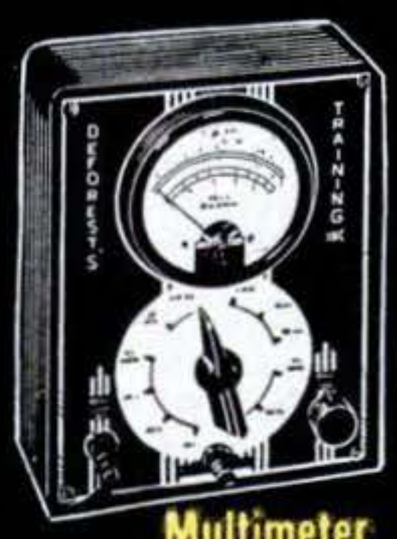

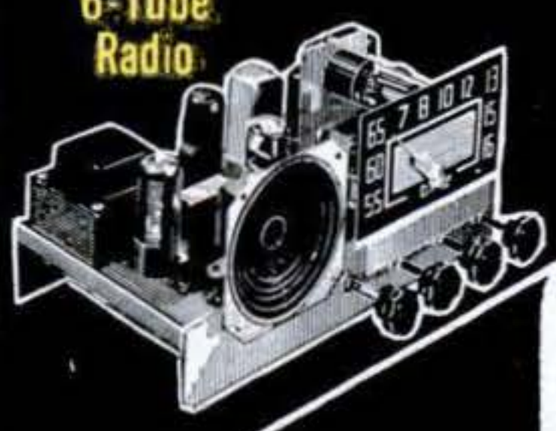

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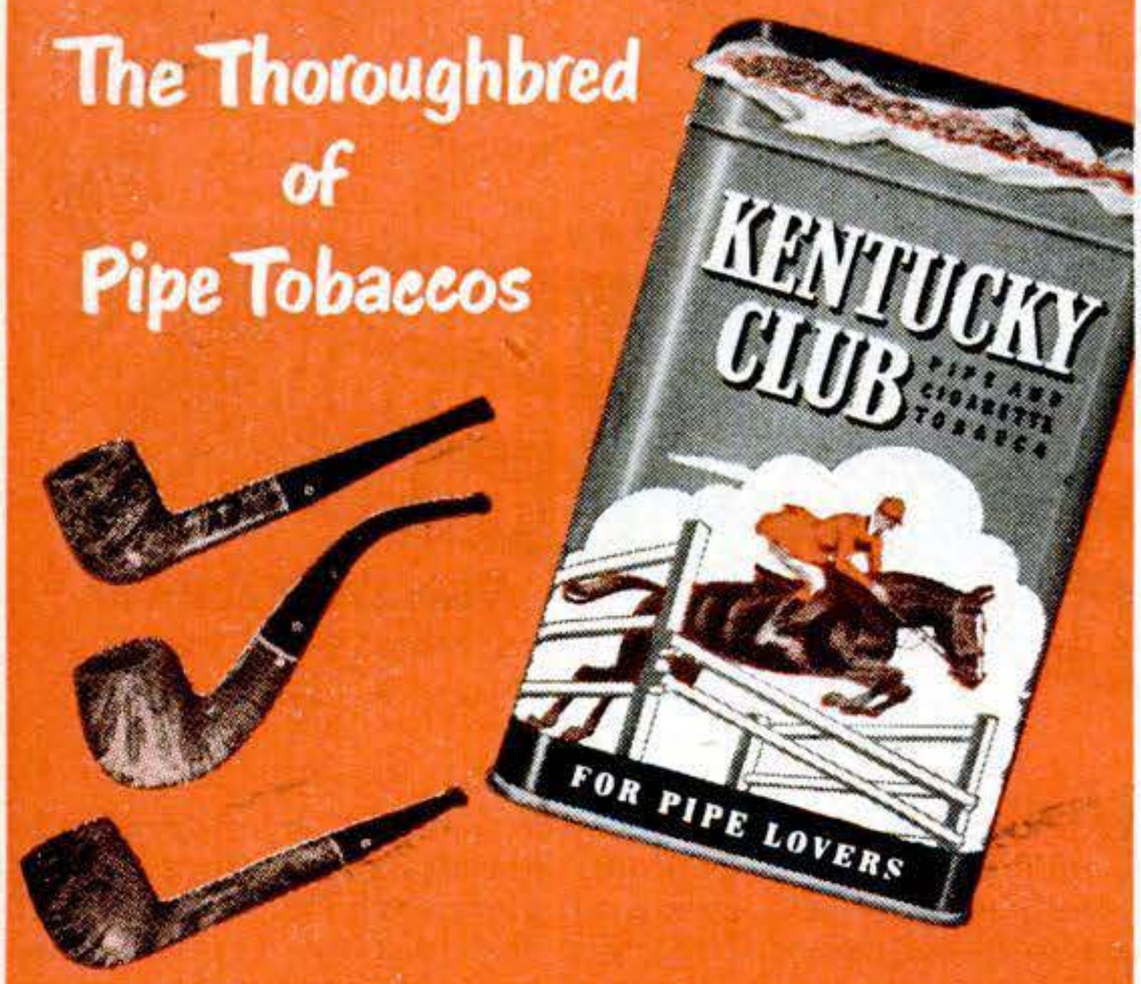

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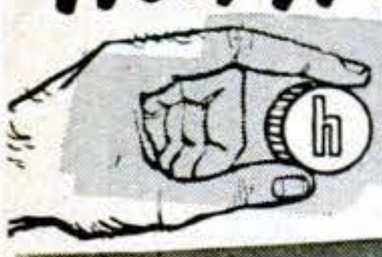

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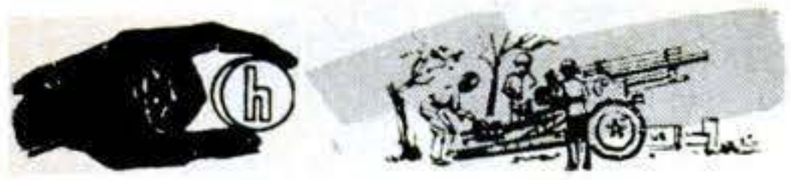

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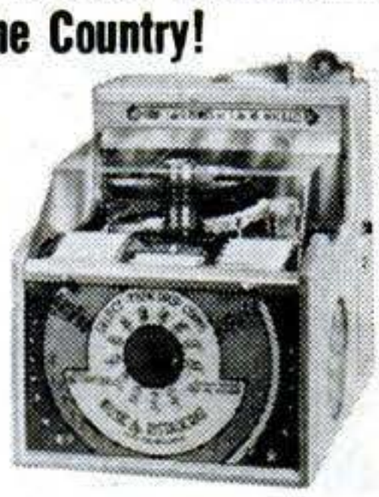

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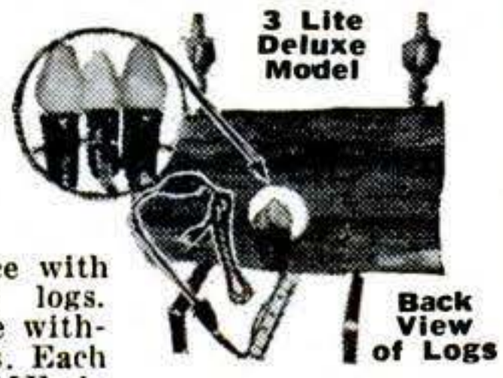

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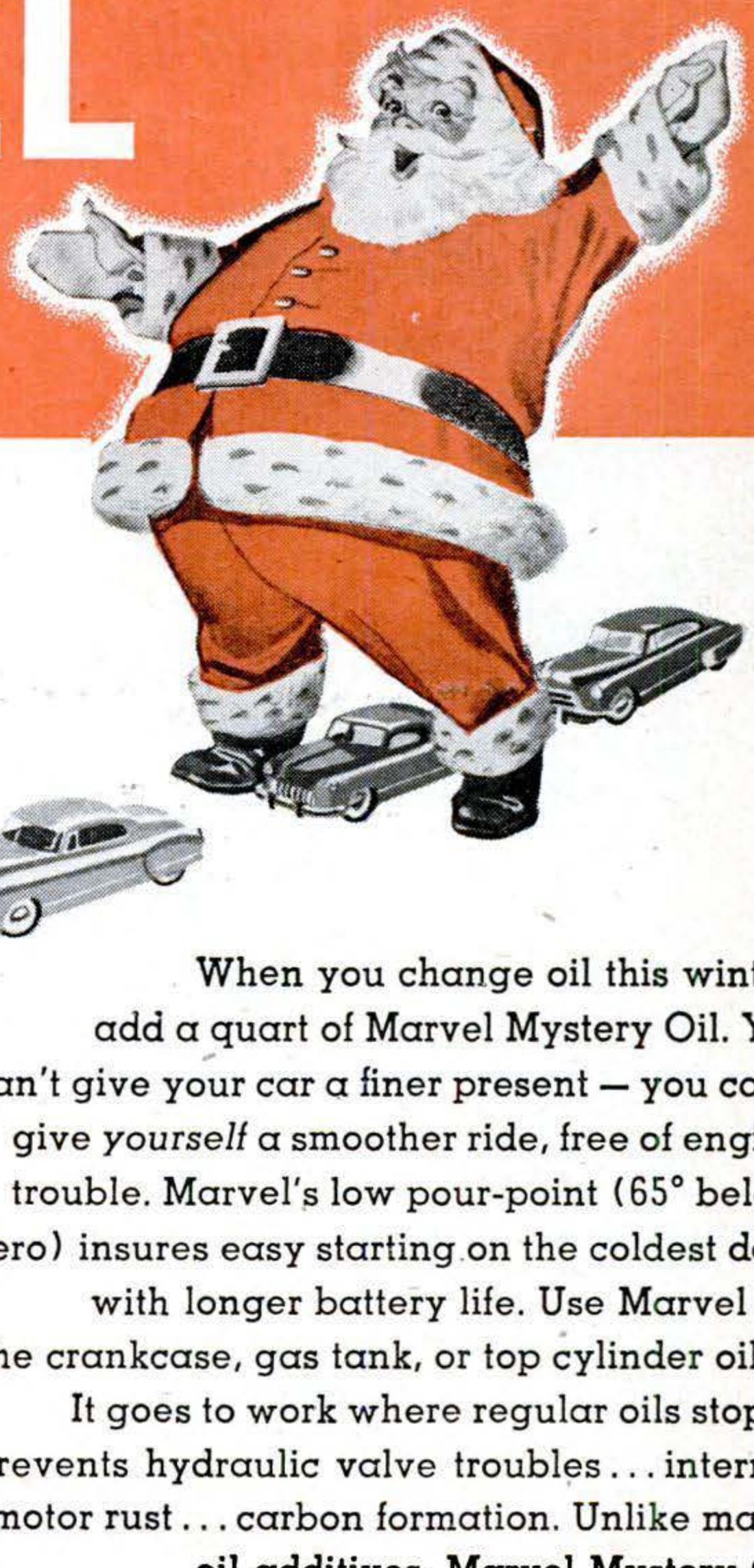

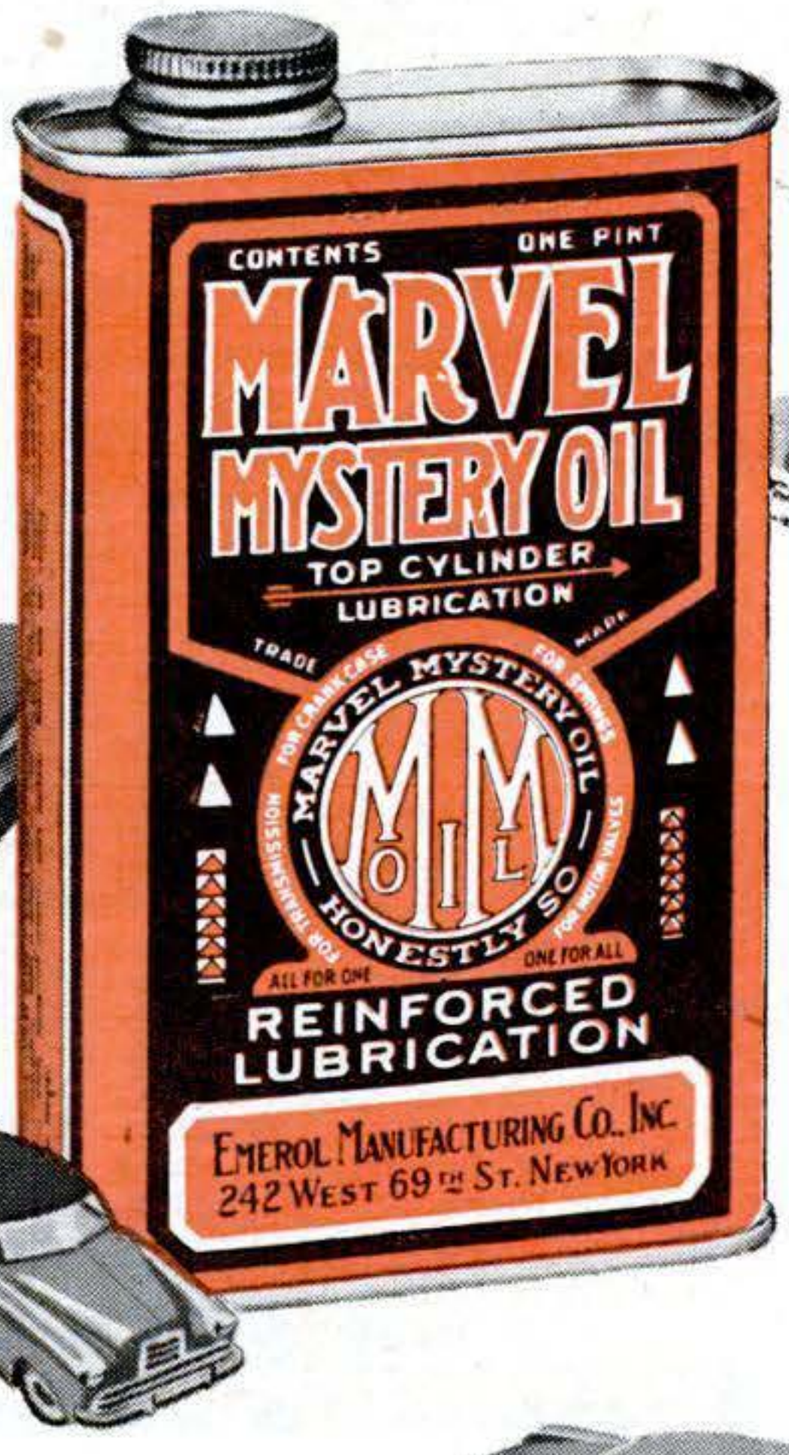

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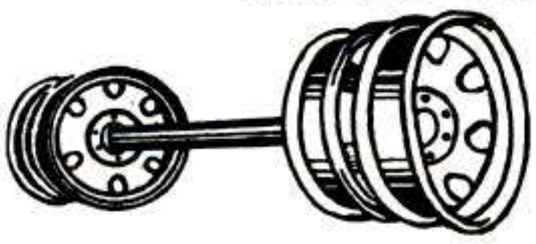

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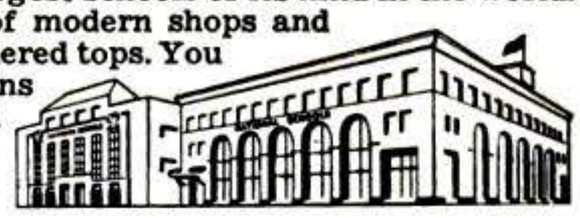

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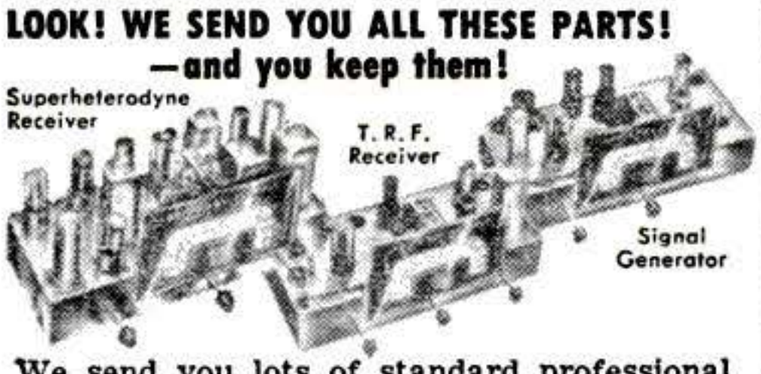

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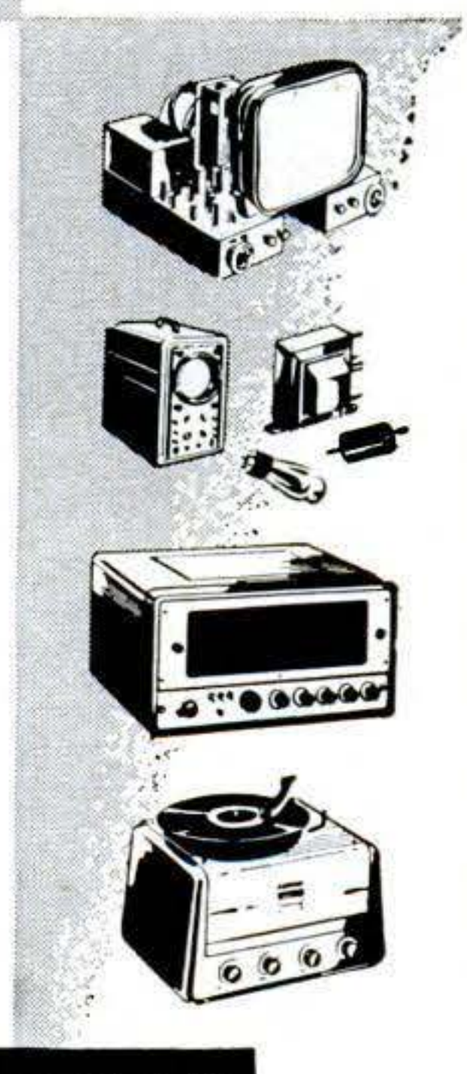

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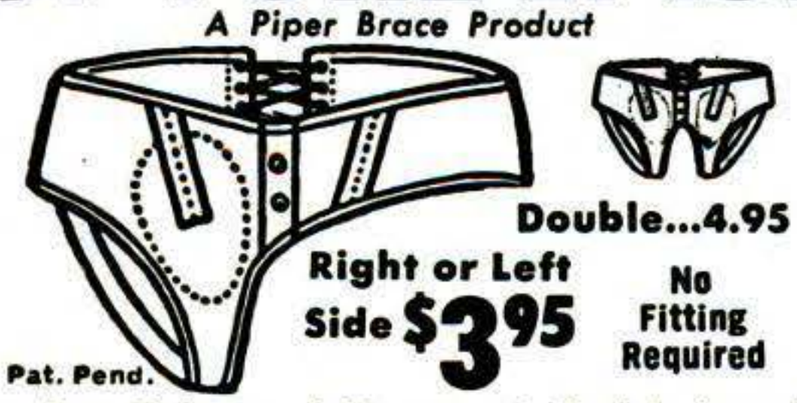

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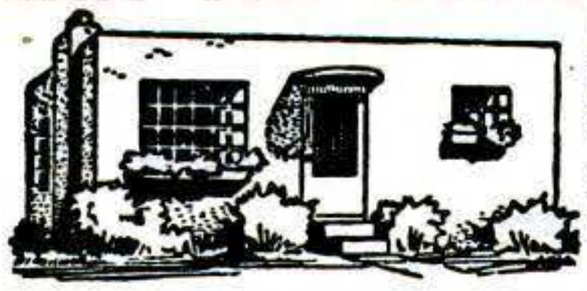

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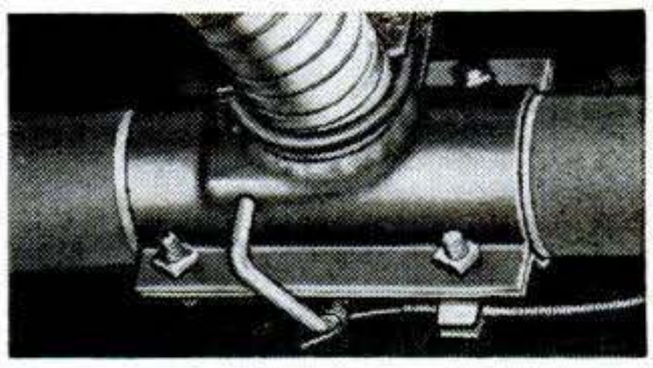

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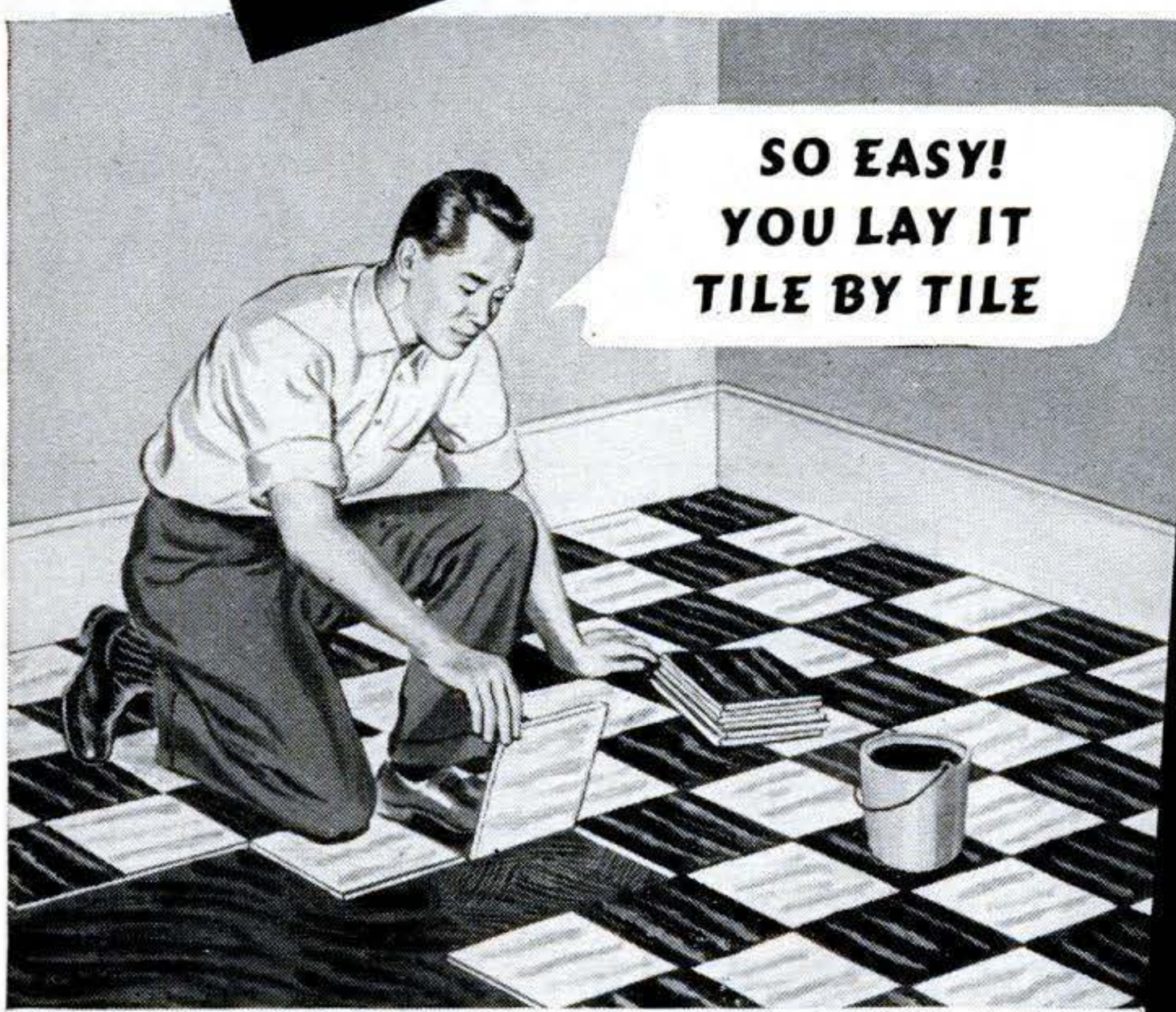

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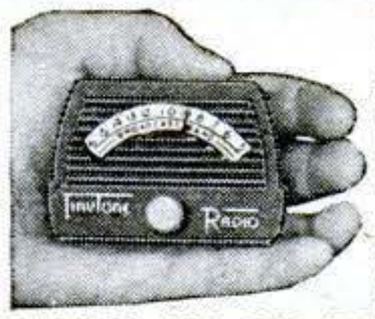

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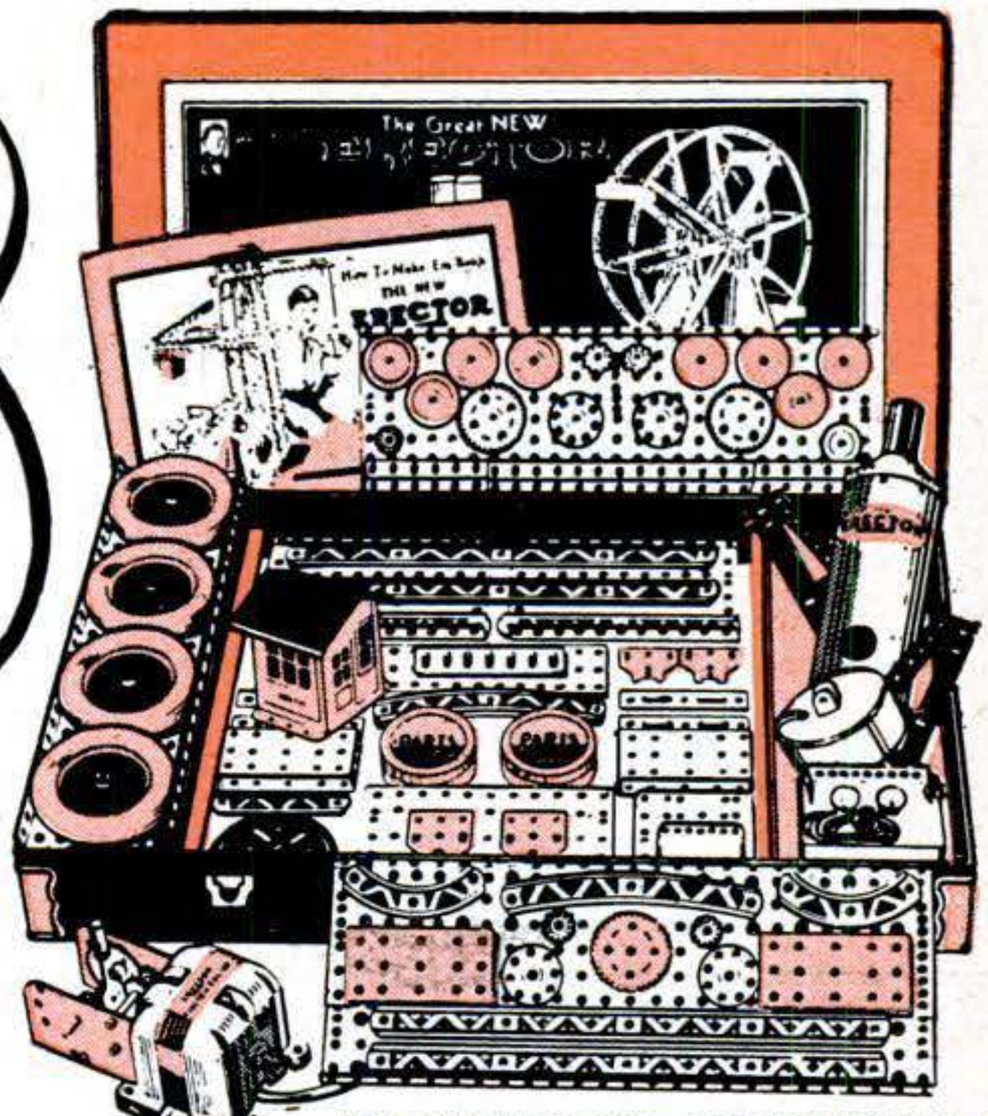

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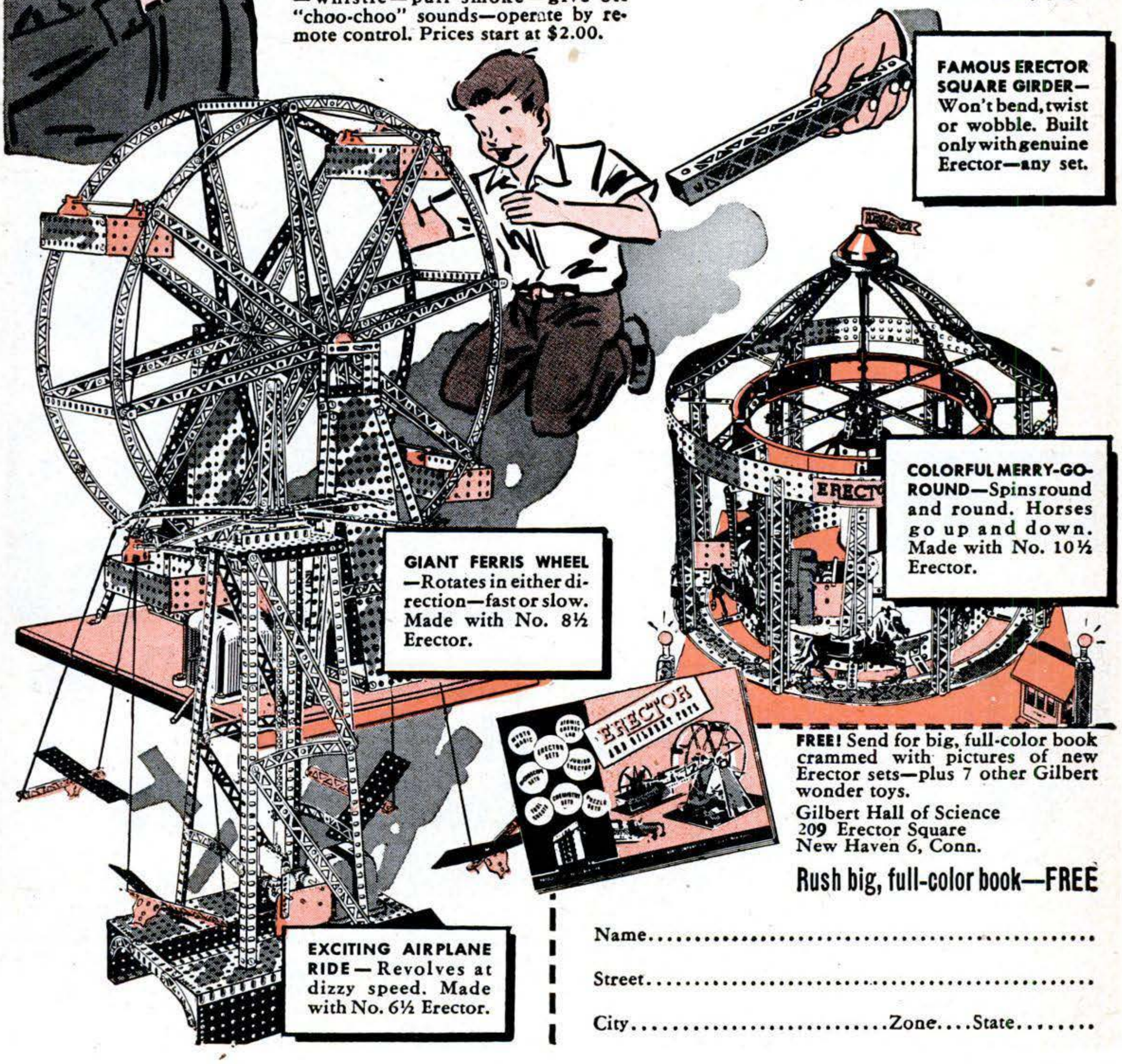

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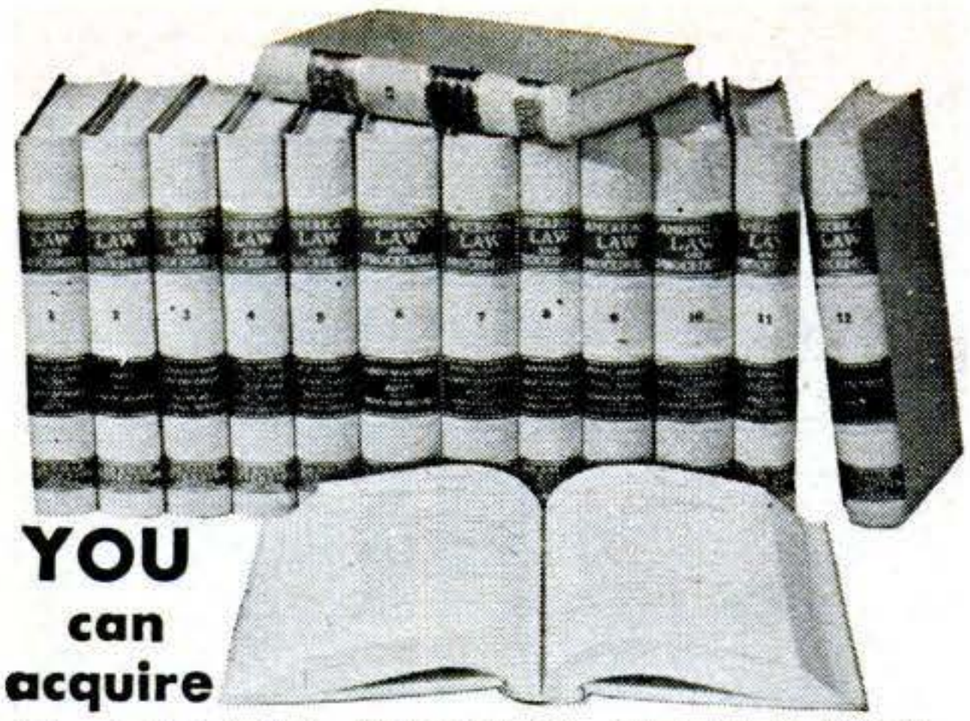

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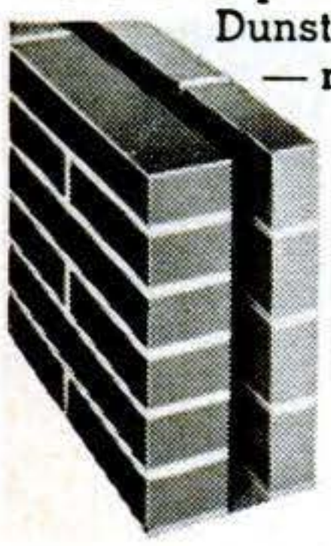

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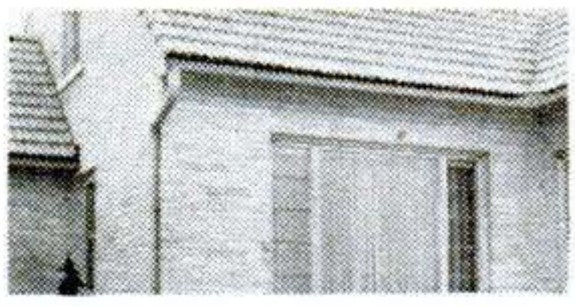

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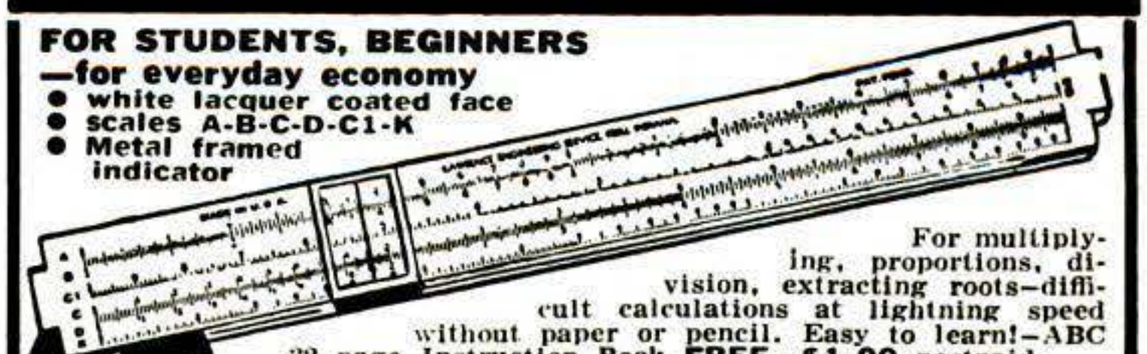

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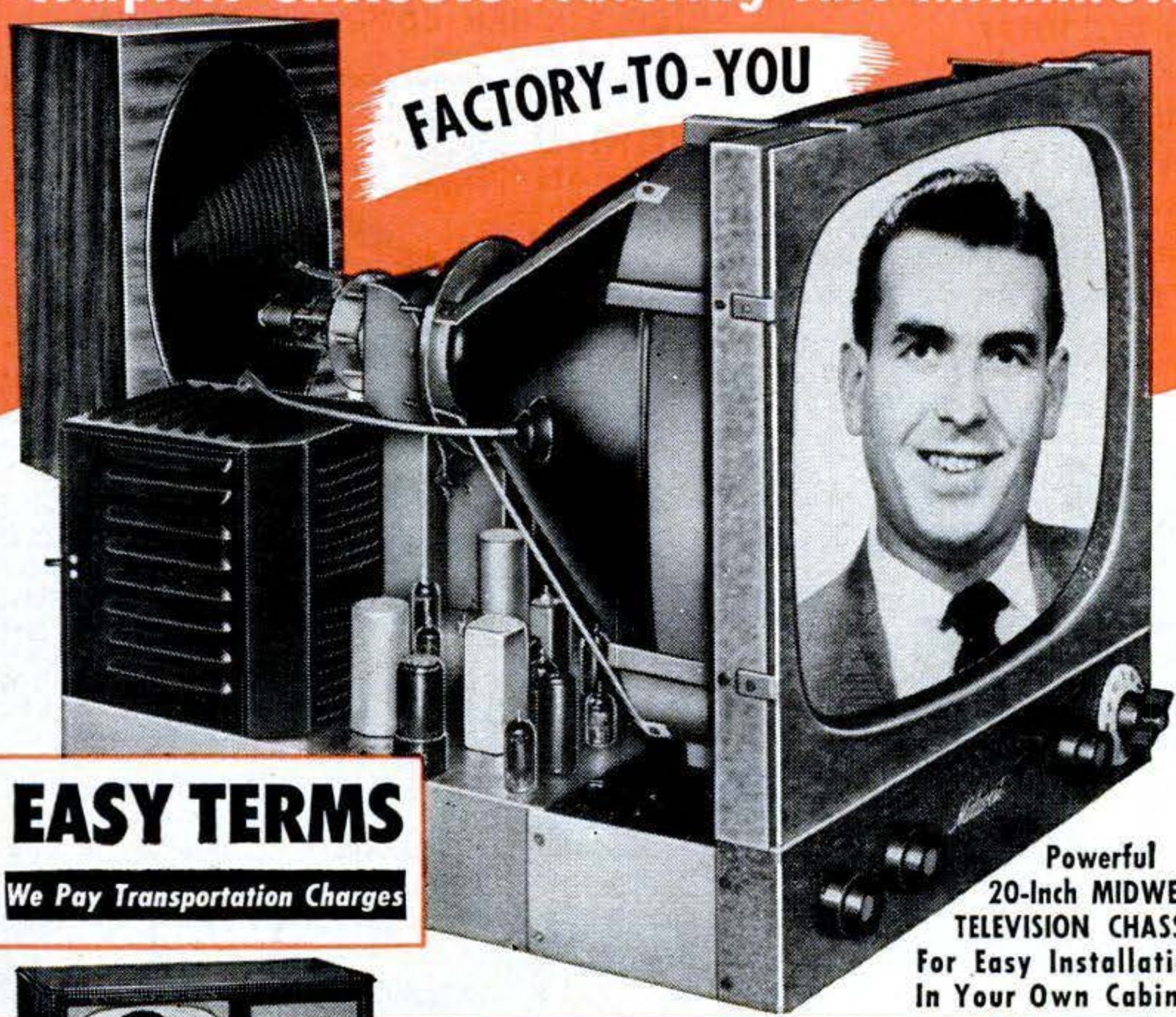

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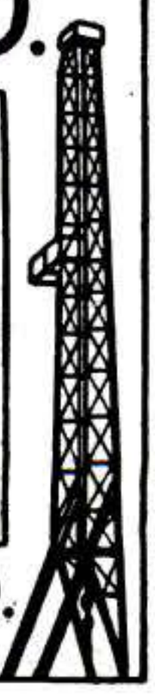

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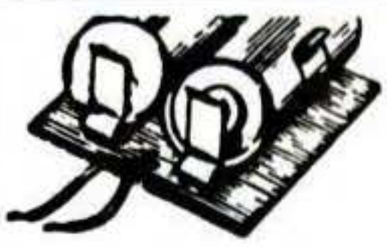

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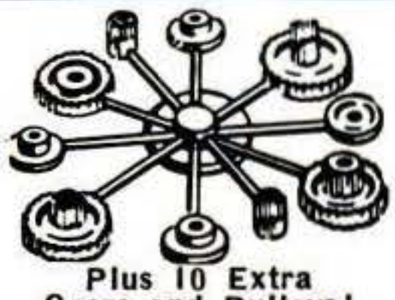

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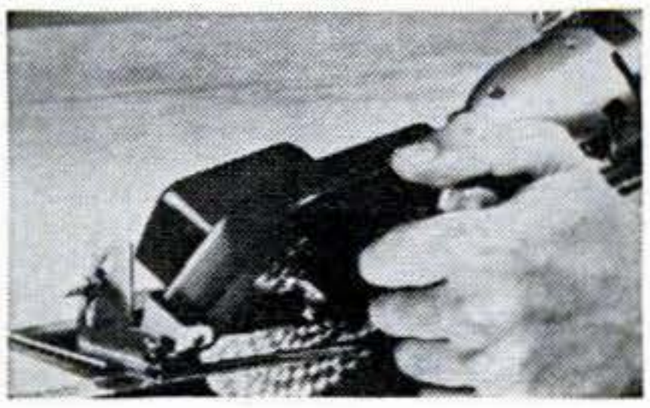

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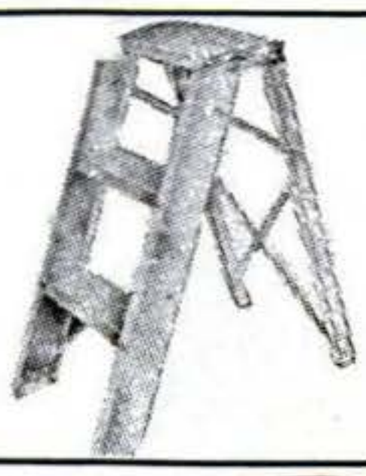

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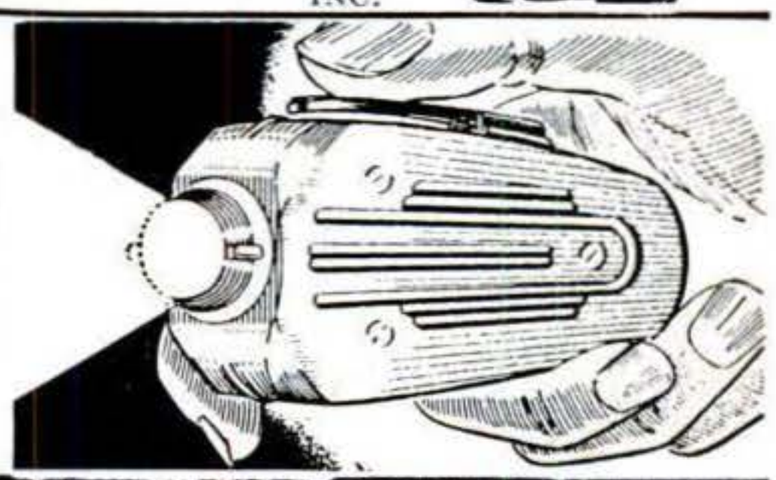

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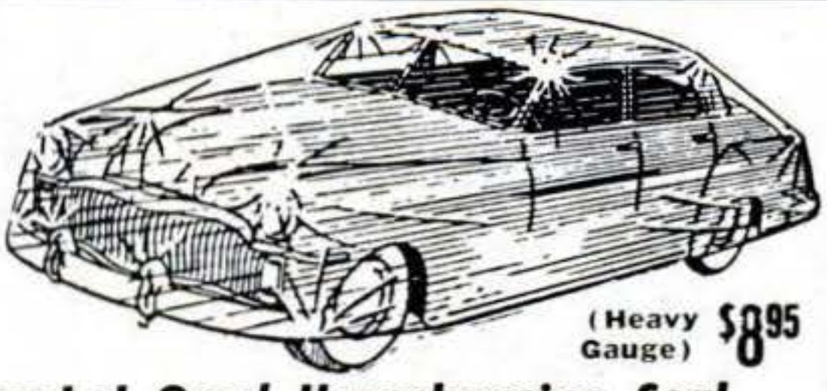

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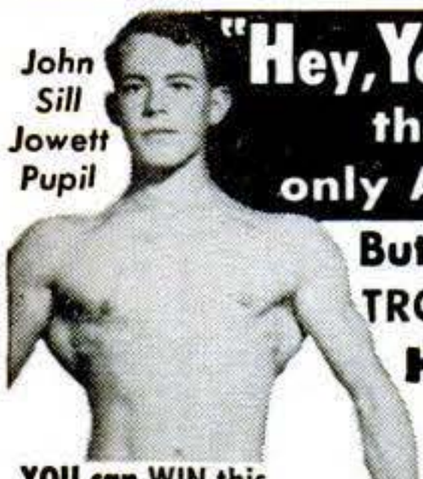

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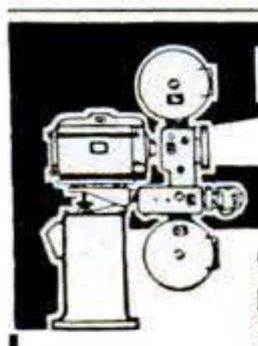

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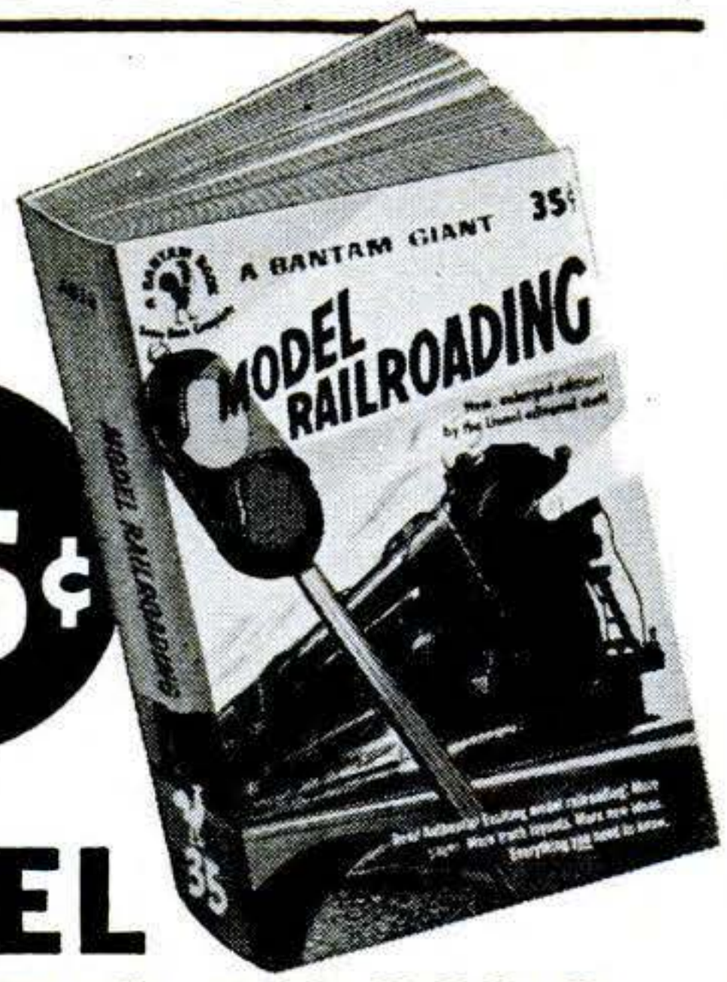

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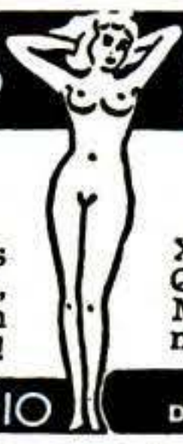

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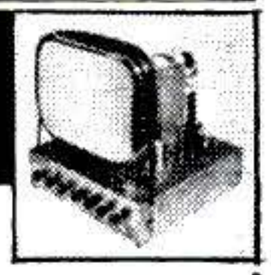

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650-16	5.42	670-15	4.74	700-20	8.54	32x6(10)	9.94
700-16	5.04	710-15	4.94	750-20	8.64	900-20	13.94
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600-16	5.49	650-15	5.95	600-20	9.94	900-20	18.54
650-16	6.42	670-15	6.24	650-20	9.94	1000-20	18.54
700-16	7.94	700-15	6.54	700-20	11.94	1100-20	18.54
750-16	7.94	710-15	6.34	32x6(8)	10.54	1000-22	17.54
550-17	5.94	760-15	6.54	32x6(10)	13.92	1100-22	18.54
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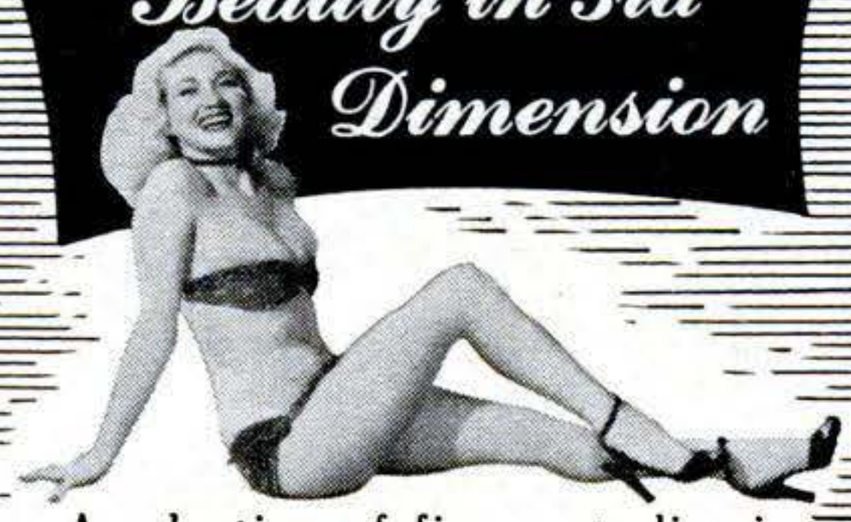

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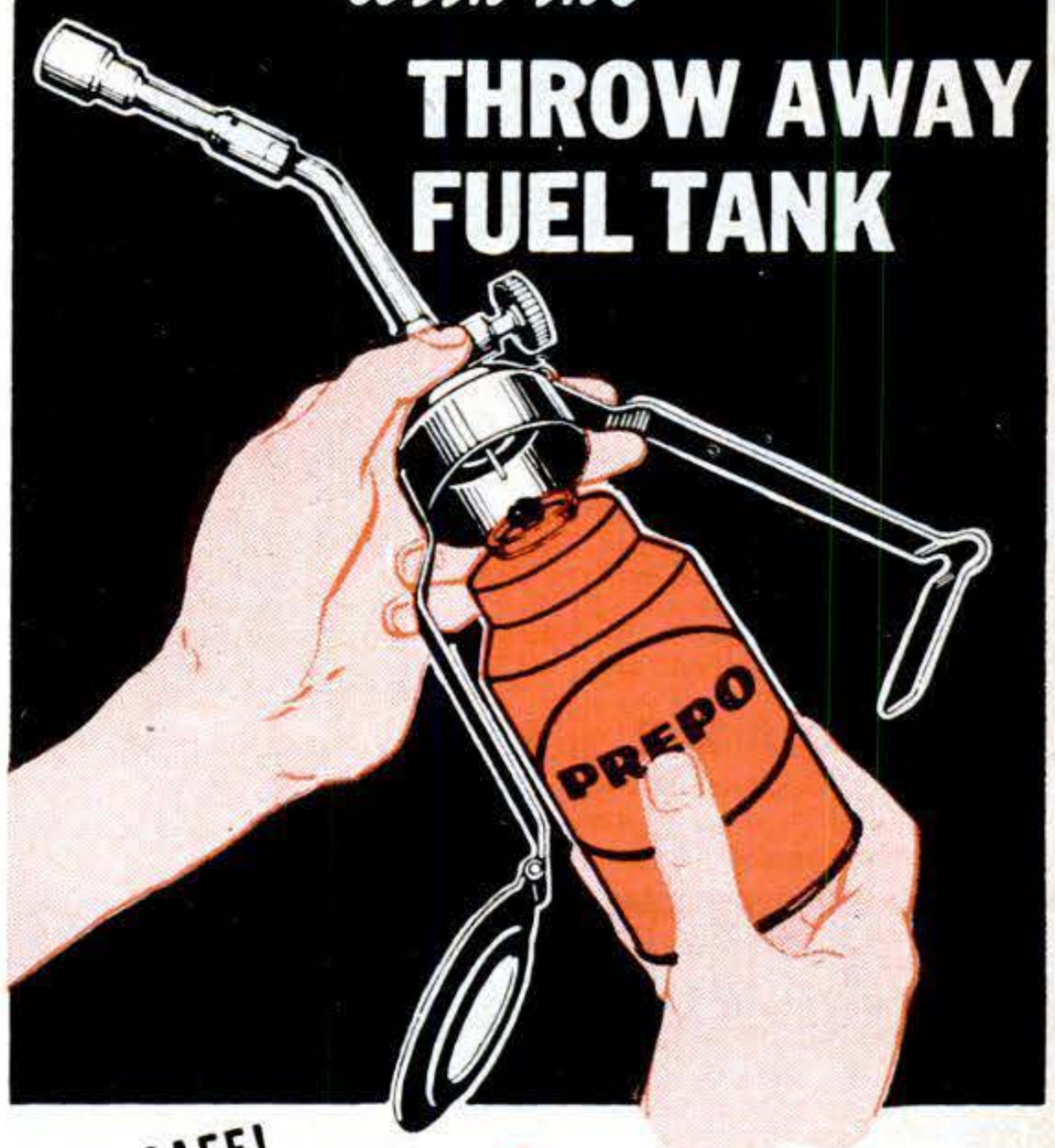

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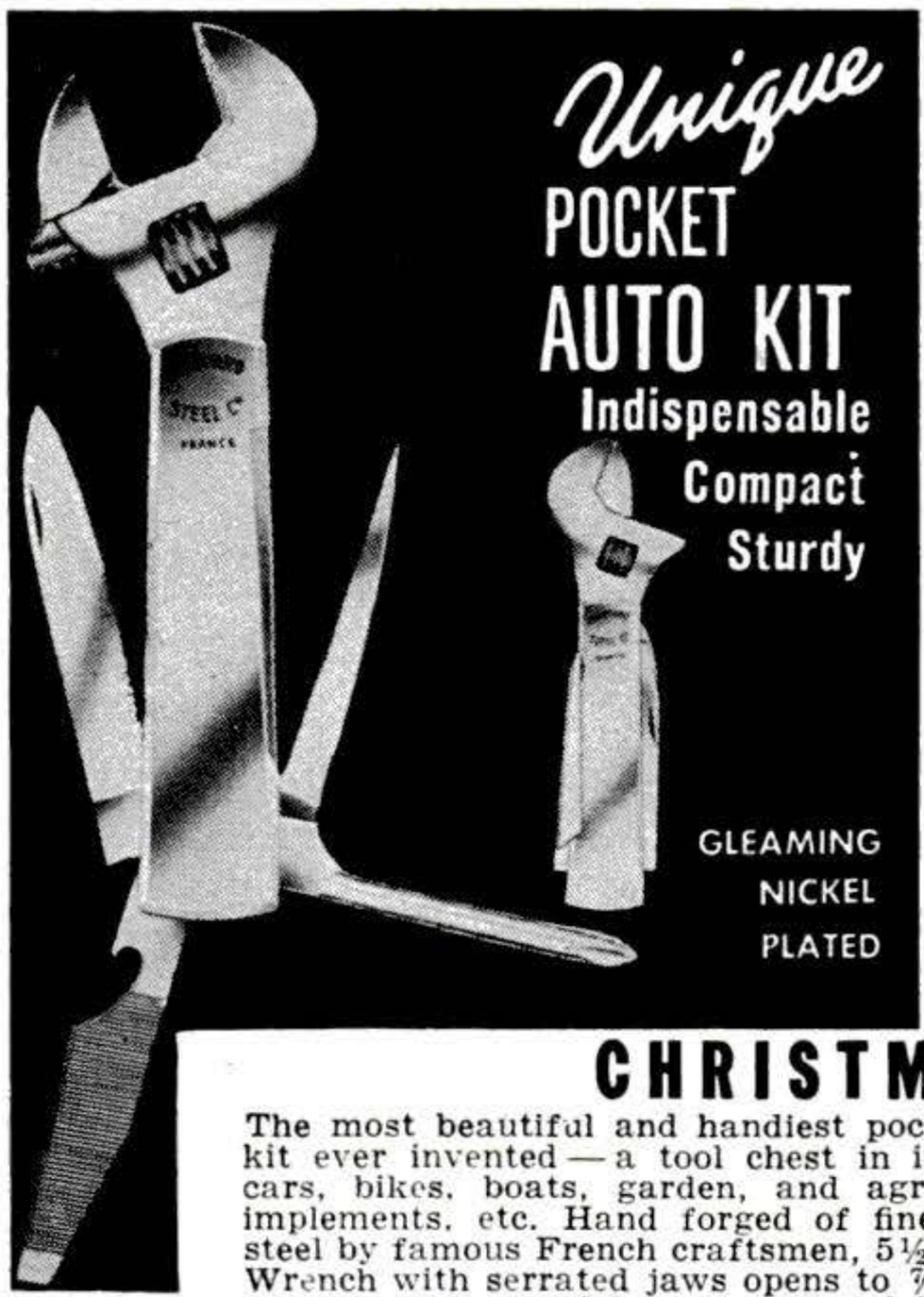

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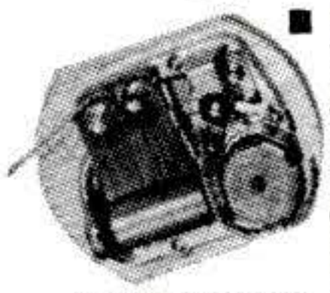

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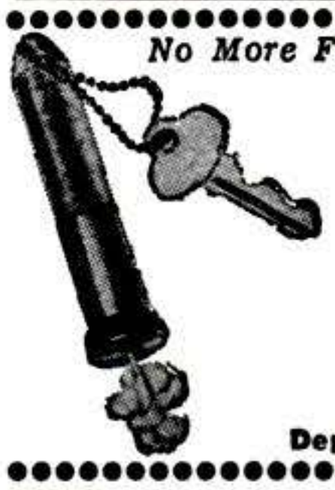

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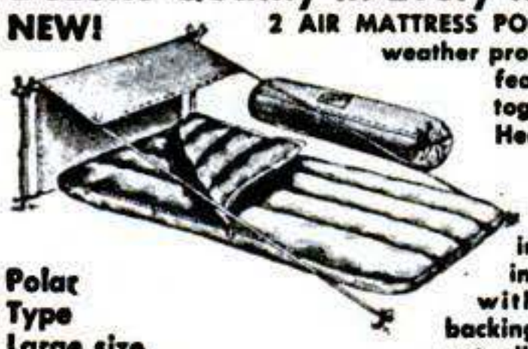

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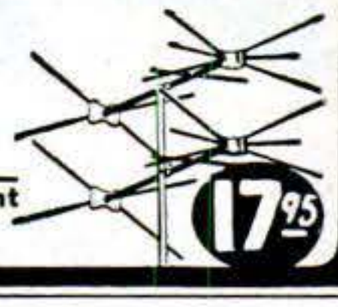

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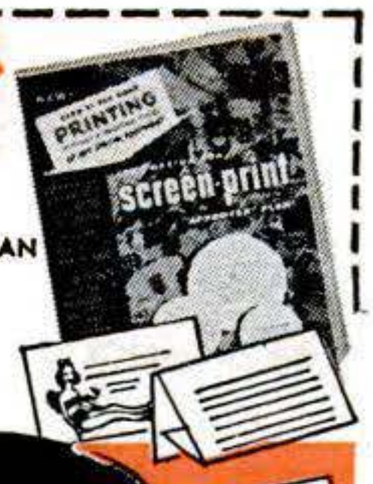

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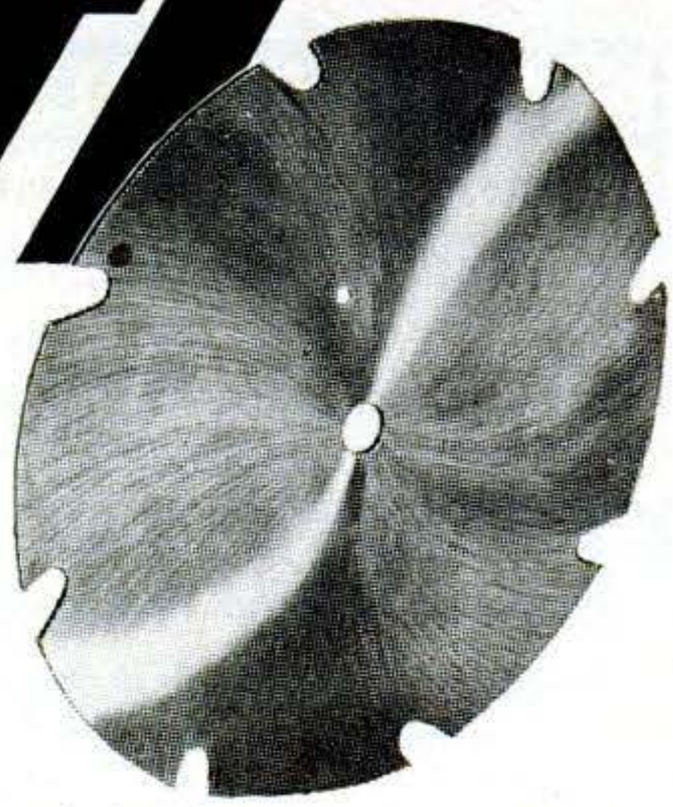

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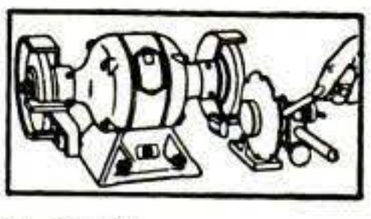

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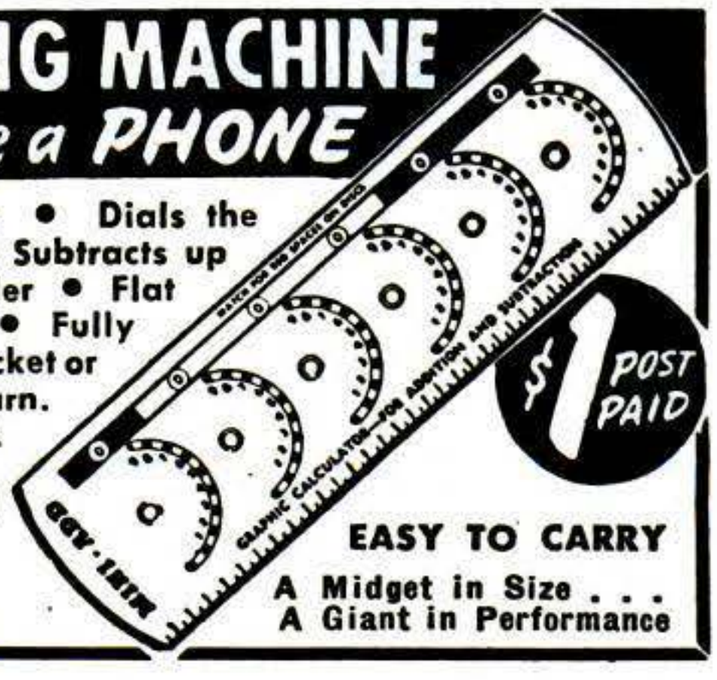

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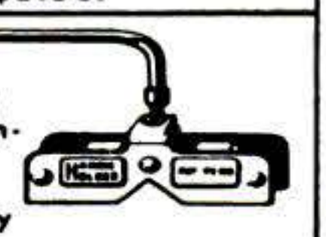

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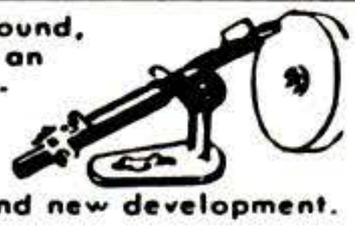

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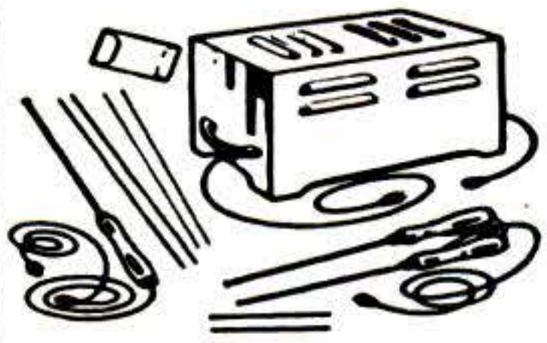

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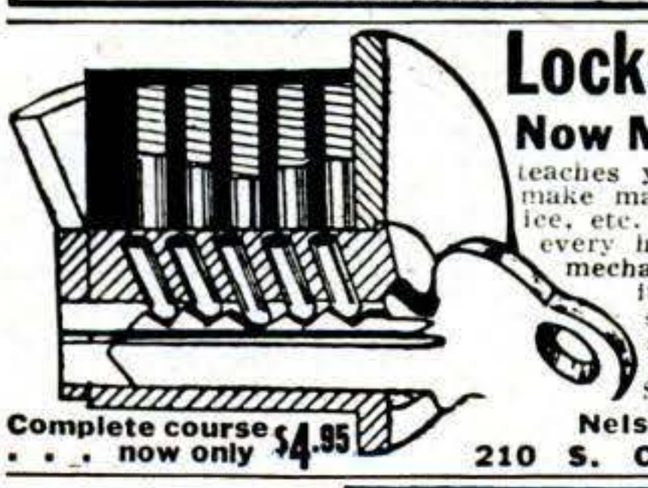

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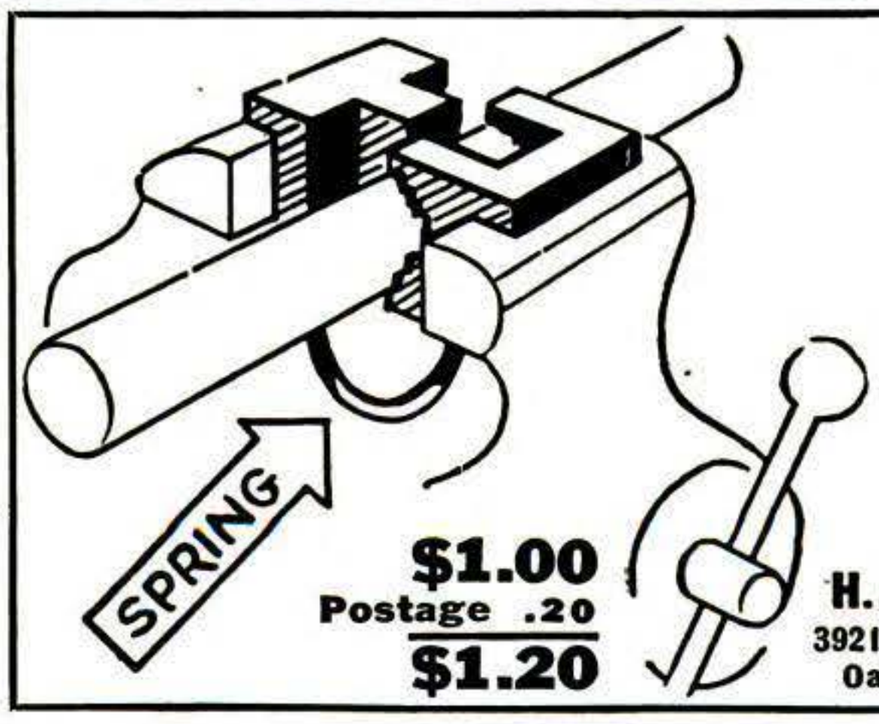

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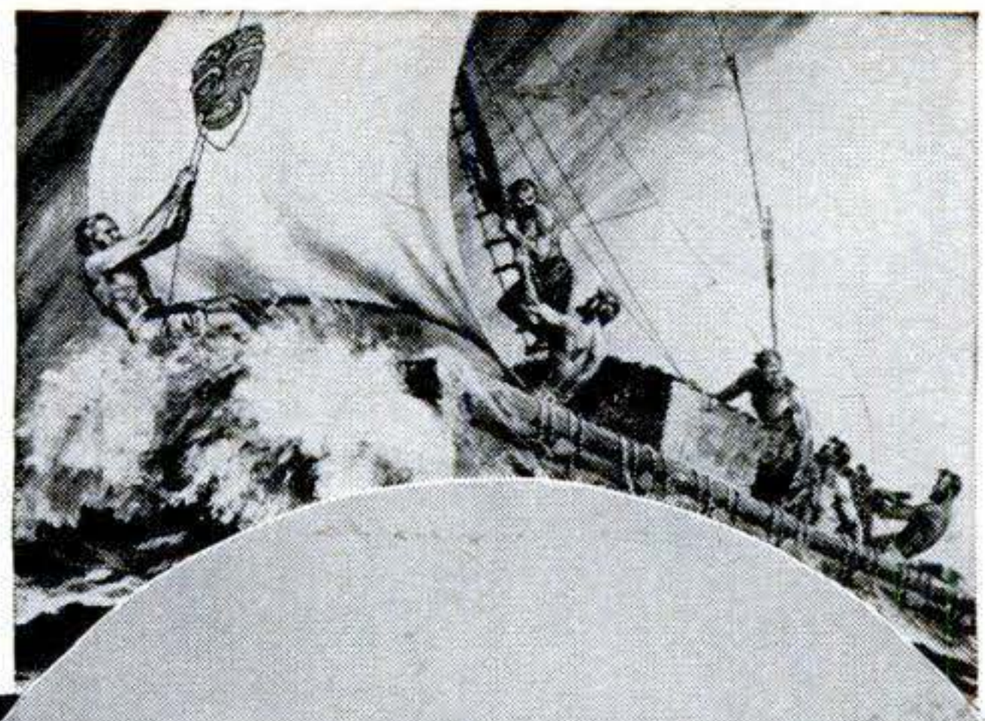

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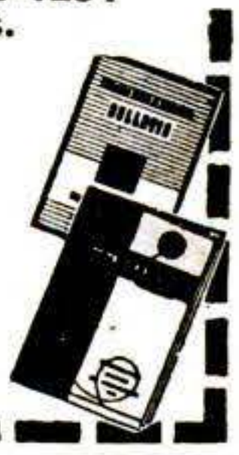

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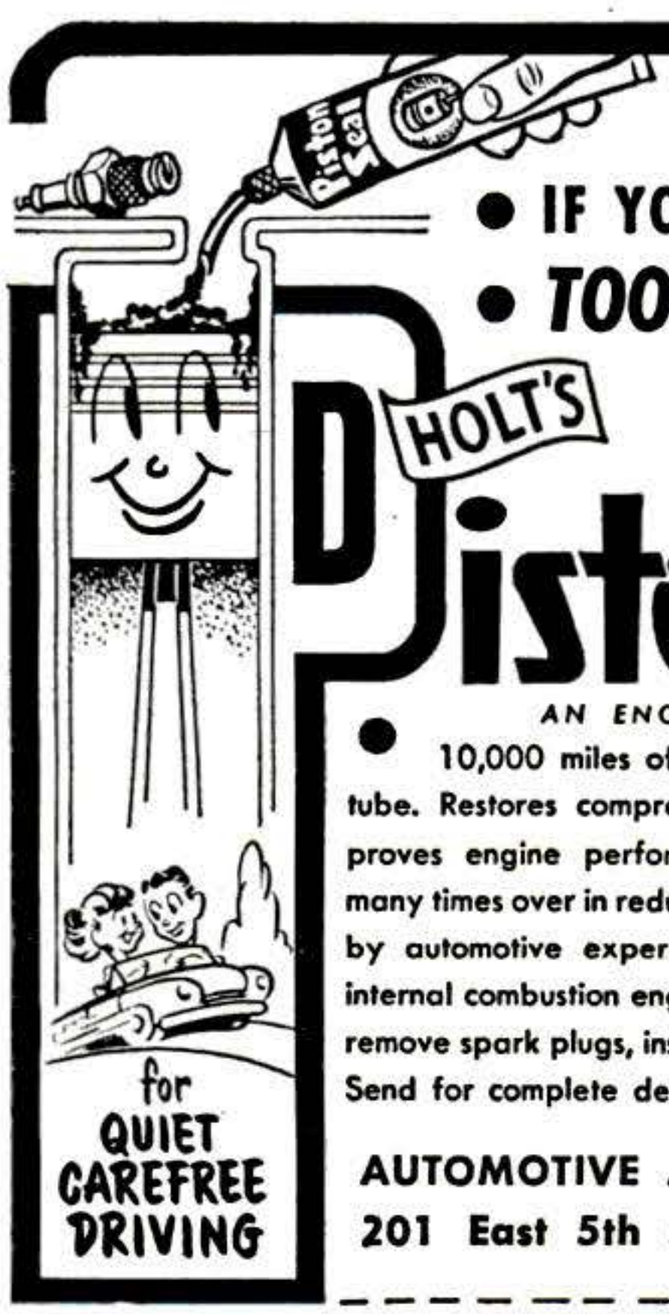

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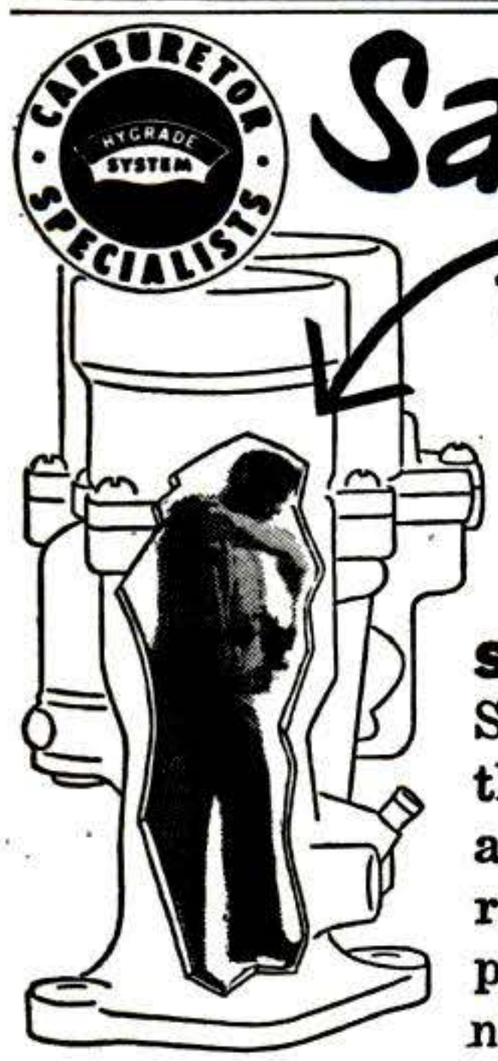

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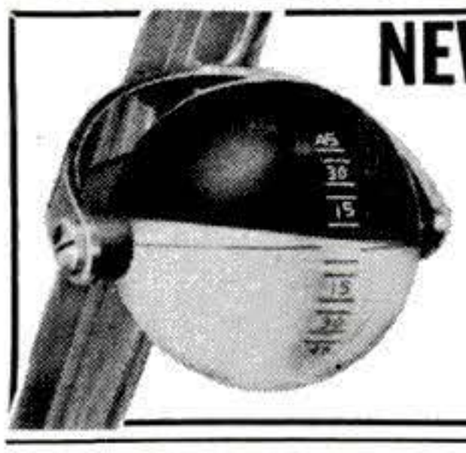

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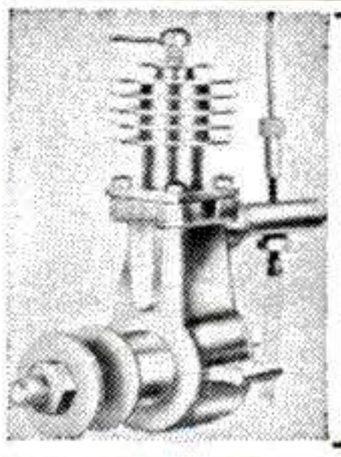

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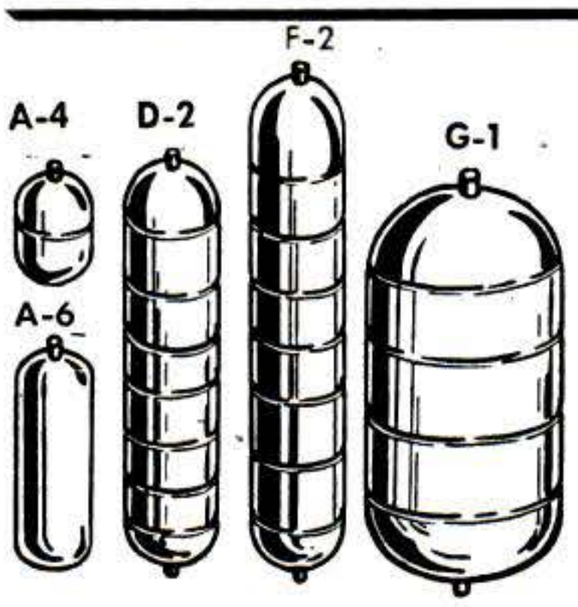

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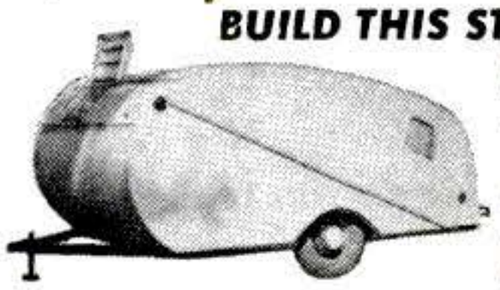

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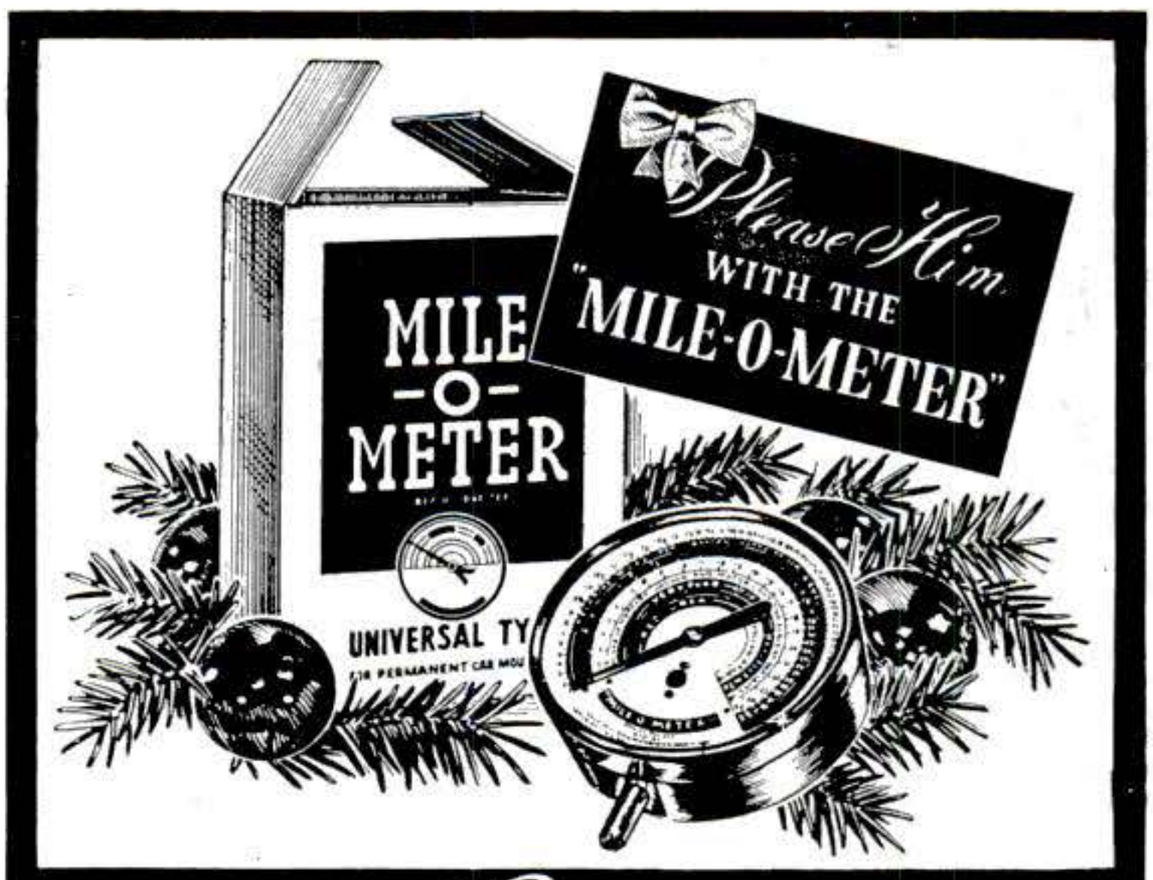

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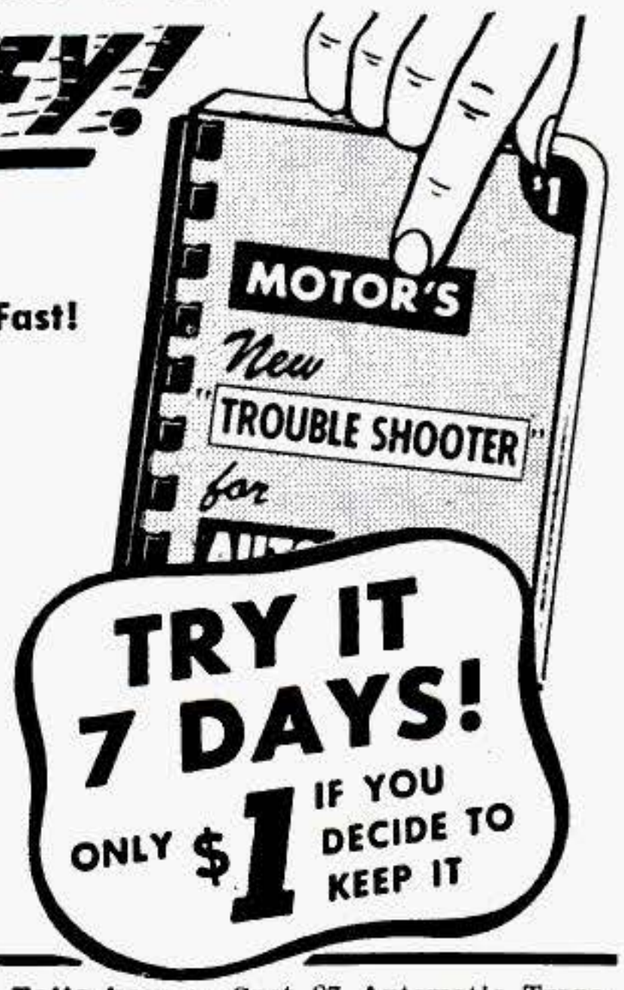

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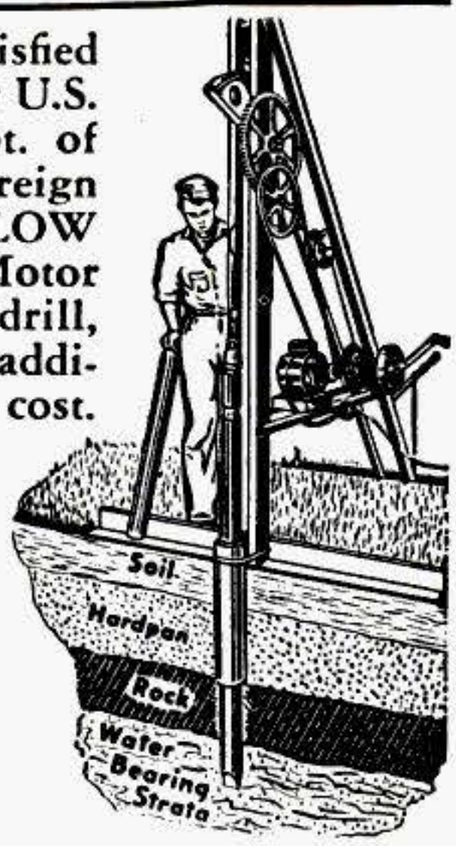

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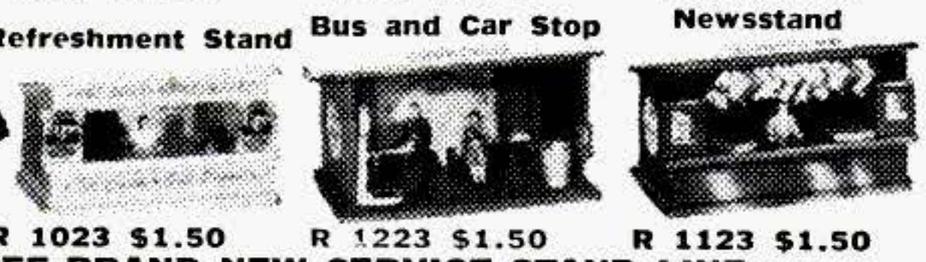

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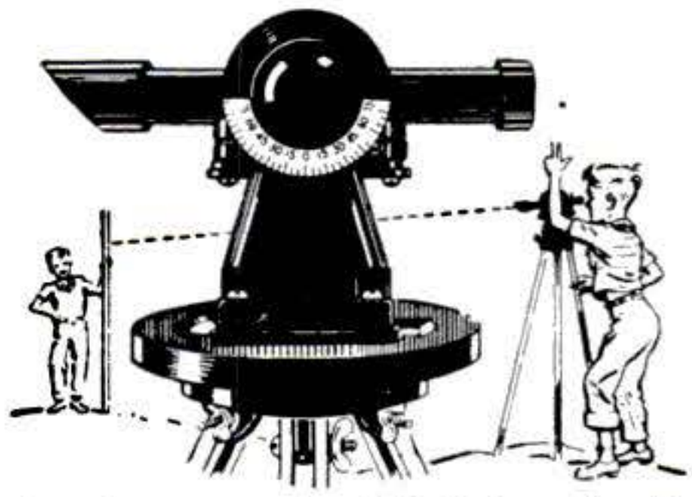

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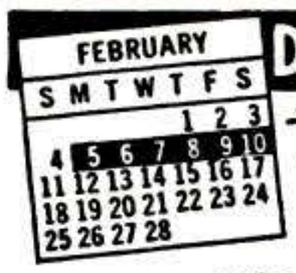

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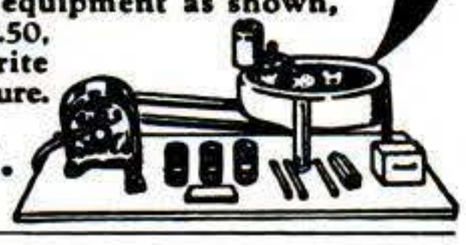

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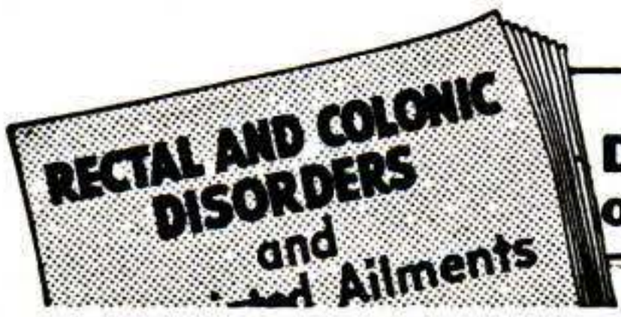

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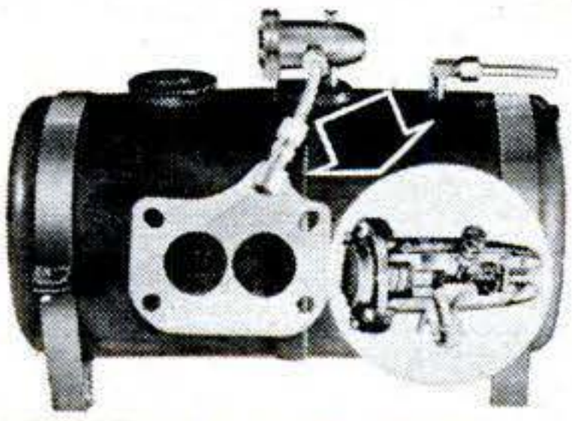

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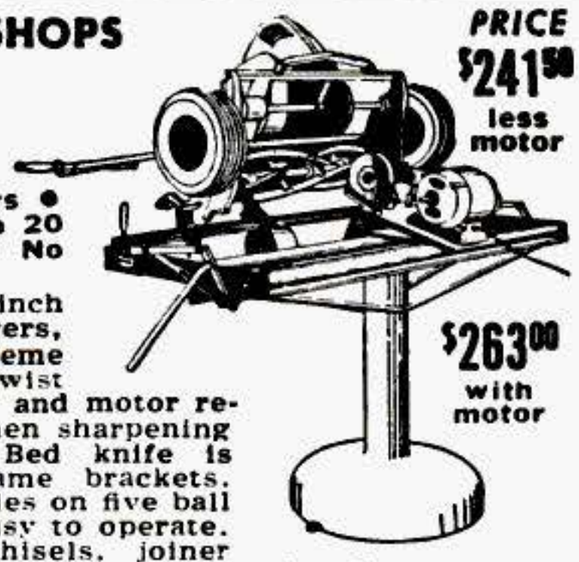

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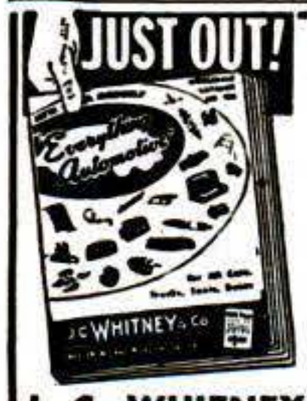

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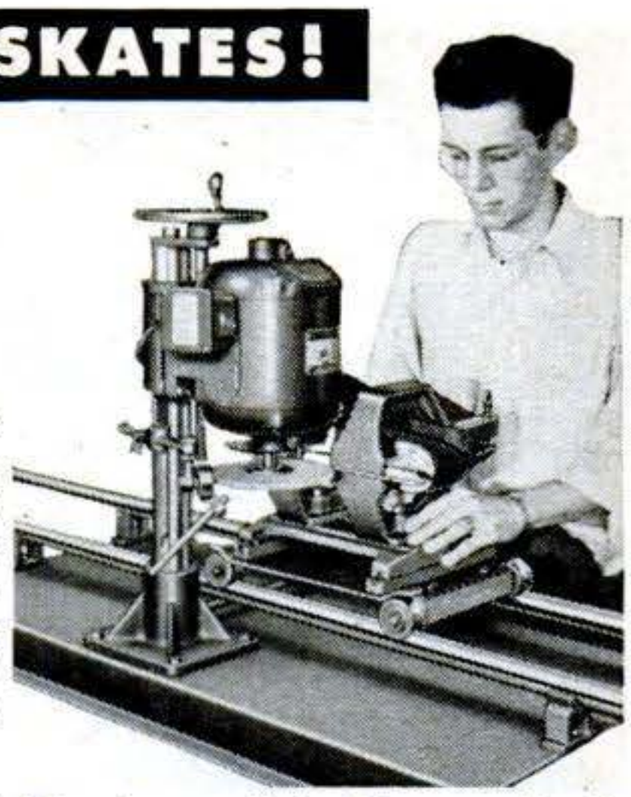

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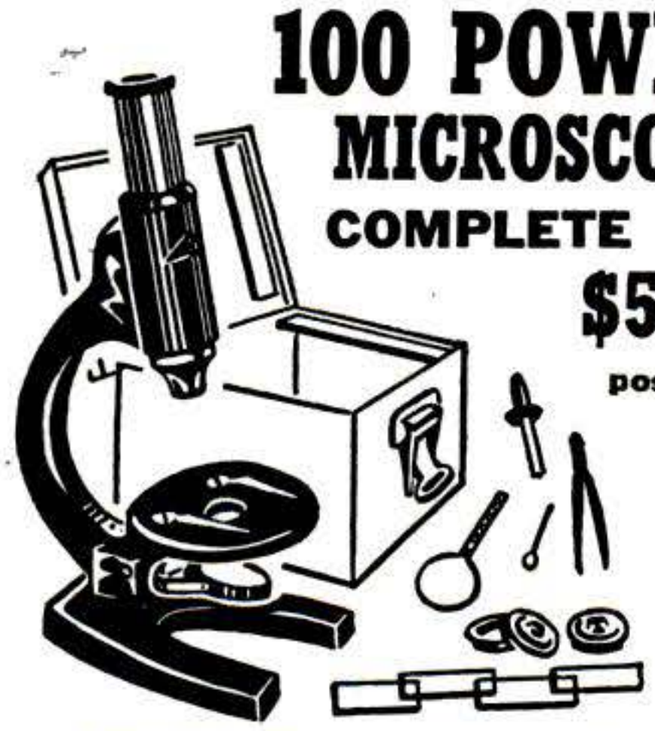

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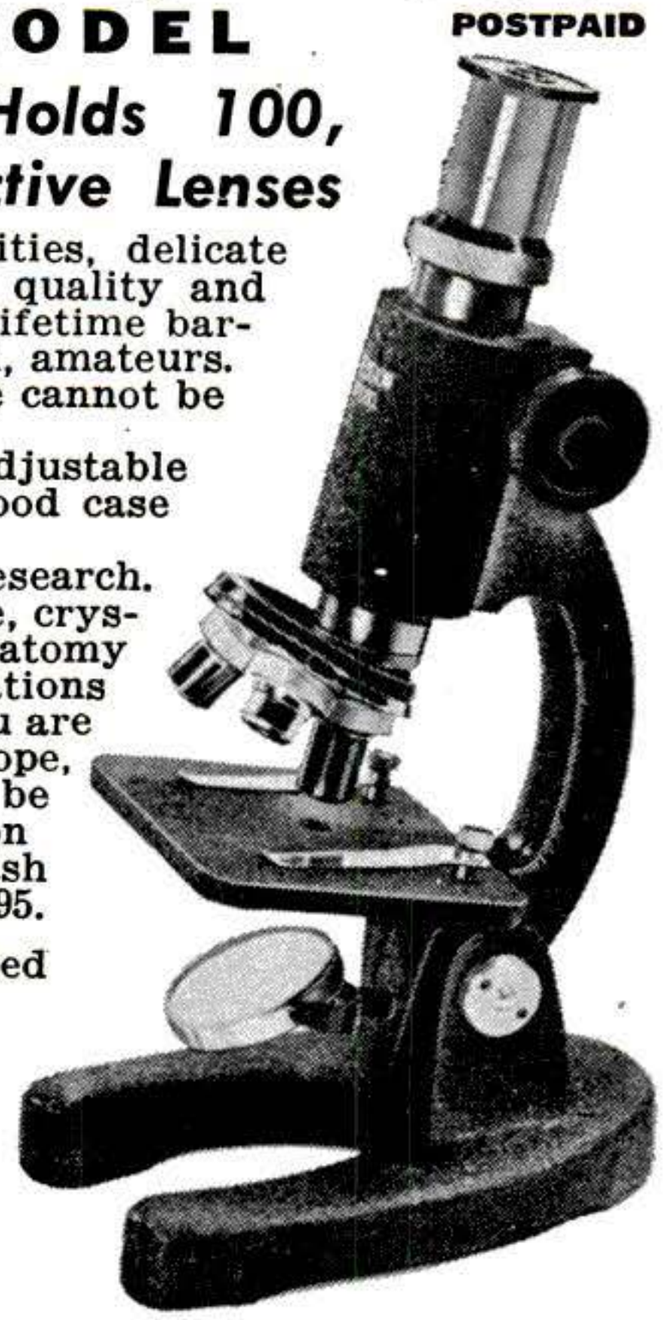

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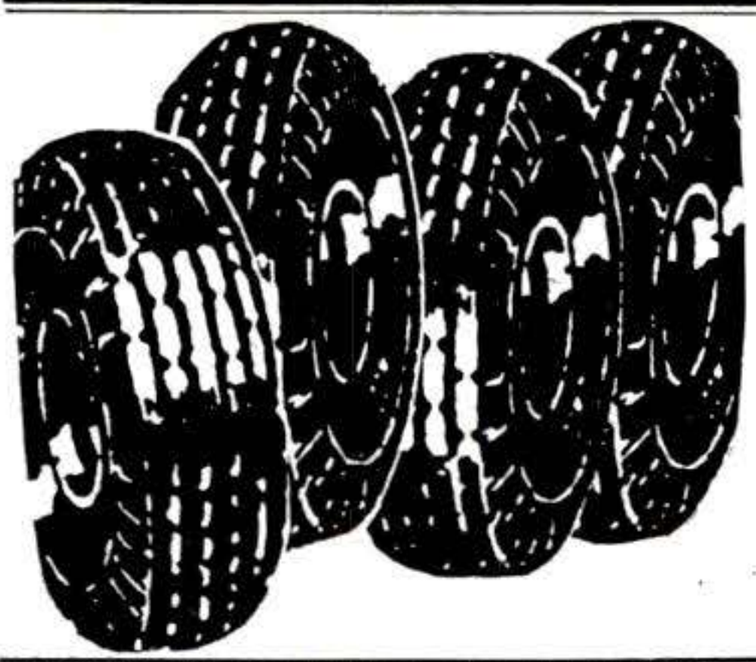

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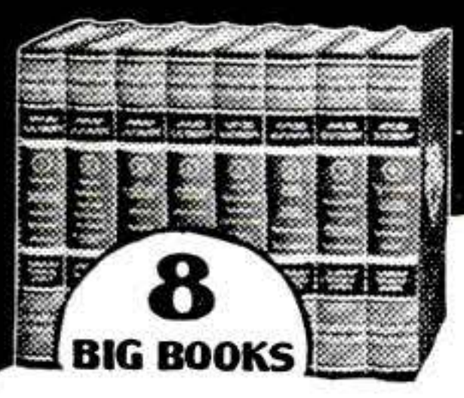

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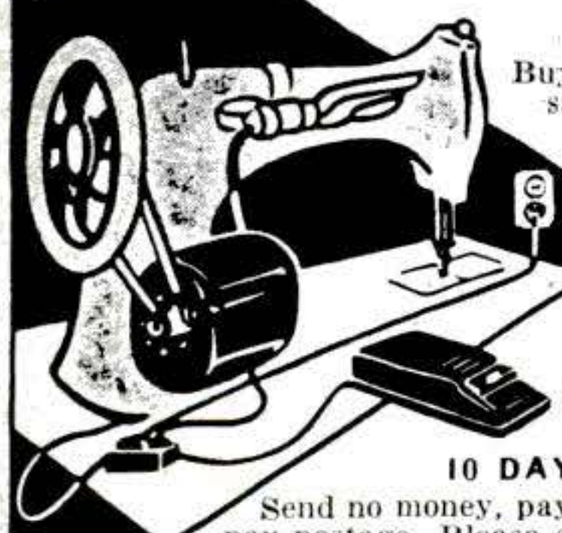

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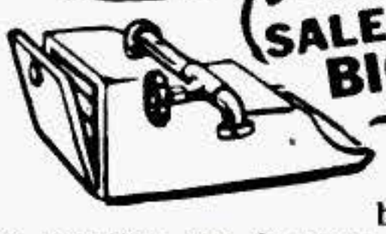

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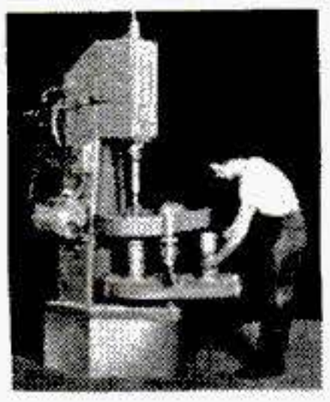

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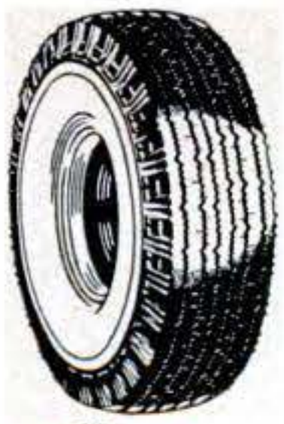

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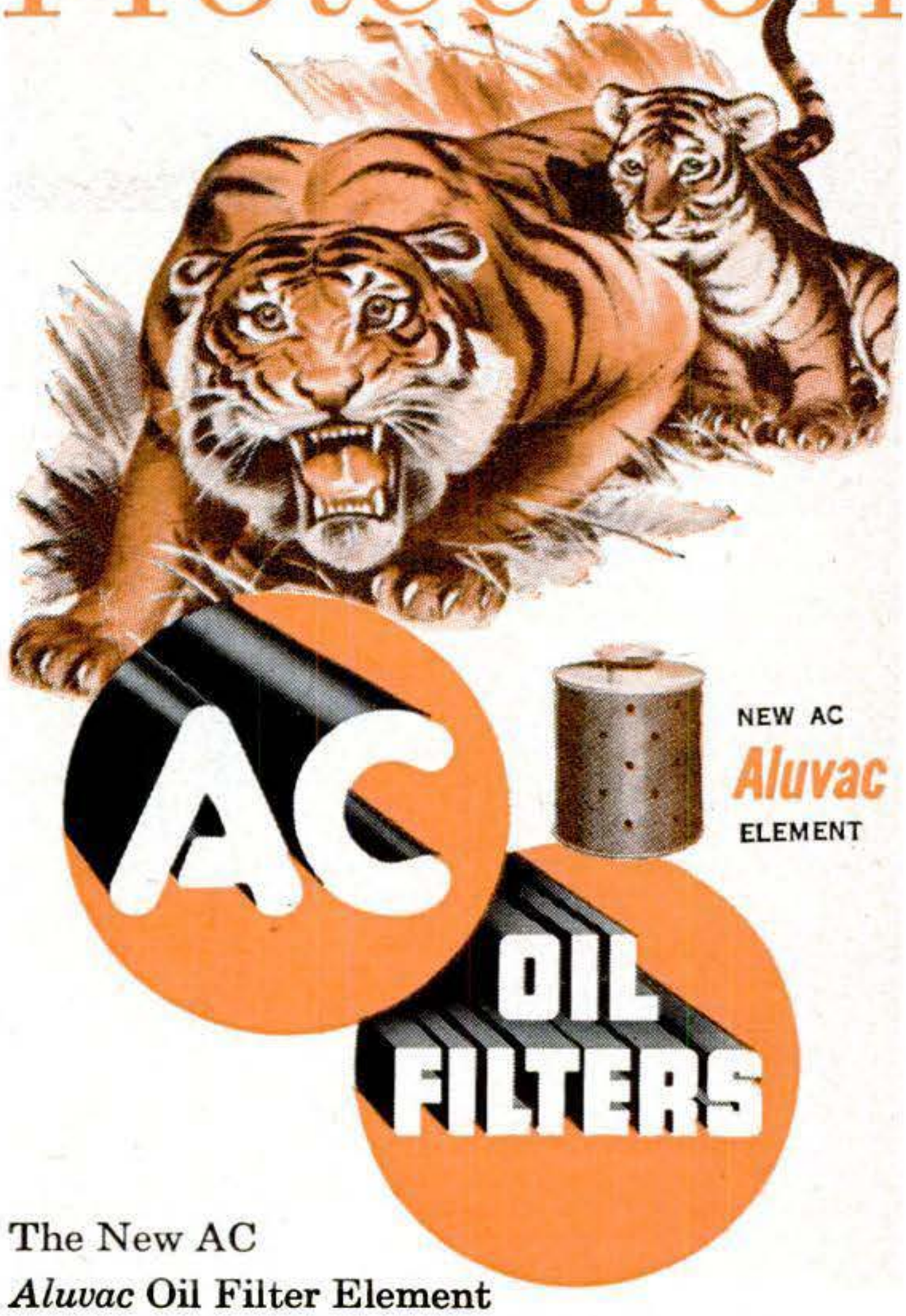

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$250 WEEK reported! Free book "505 Odd, Successful Businesses." Work home! Expect something Odd! Pacific-99C, Oceanside, California.

BUY it wholesale. Manufacturers, Distributors. Over 850,000 items. Literature free. Olsen, 1231-B East Third St., Duluth 5, Minnesota.

BOOKKEEPERS—Operate profitable "No-Ledger" bookkeeping service. Write Frye, Box 432, Chester, South Carolina.

BUY nationally advertised watches wholesale . . . Sell to friends and others for Christmas . . . No stock to carry . . . Wisuri, 10 Railroad, Maynard, Mass.

BUILD Drive-In Theatre your community. $1.00 brings information. State Amusement Co., Box 16, Metz, W. Virginia.

MAILORDER advertising unproductive? Eliminate guesswork! Quicken results! Investigate! Finkle Advertising, 6758-S Hollywood Boulevard, Hollywood 28, Calif.

ELECTROPLATE Giftwares, novelties, baby shoes, jewelry, auto parts, mirrors. $5.95 includes electroplater, plating salts, formulas, electroplating manual. Tyco Metals, Box 13231-CD, Houston 19, Texas.

MAKE money addressing envelopes. Write for full particulars. Malco Company, 12-PS, Columbus 5, Ohio.

MAKE ming trees. Extremely popular. Tremendous profits. Free colored pictures. Bazaar Foreign Arts, 202 Que, Sacramento, Calif.

HOMEWORK—Addressing envelopes. Details 25c. Siegal, Box 183-PS, New York 2.

RUBBER molds. New Catalogue illustrating over 100 professional molds. 10c. Castcraft Studios, 508-PS Marion St., Brooklyn 33, N. Y.

REALLY Comic Christmas Cards—Fast Sellers: $1.00—Brings you three sample sets. Midstates, Box 412, Bloomington, Ind.

$46 FROM Square Foot Plywood; Jigsaw necessary. Write: Woodart, Bridgewater, Massachusetts.

MAILING postcards selling repeat merchandise is profitable. Everything supplied. Details free. Gordon Publishers, Box 23, Pawtucket, R. I.

INVISIBLE Reweaving. Men-Women. Instructions shipped for no-risk examination. $5.00 hour possible spare-full time. Reweave burns, tears, moth-holes like new at home. Free details. Skilweave, 1717-FC Westwood, Los Angeles 24.

MAKE Rubber Stamps, repair dolls, learn invisible reweaving, repair sewing machines. Catalogue of "40 Ideas." Universal, Box 1076-B, Peoria, Ill.

SAWDUST. Turn it into cash. Twenty methods. Instructions 50c. Charles Company, 12-CMD, Norwood, Ohio.

38 MONEYMAKING OPPORTUNITIES

QUICK profits taking magazine subscriptions, handling greeting cards. Cassell Publishers Service, Westfield, N. J.

DETECTIVES Earn Big Money. Experience unnecessary. Detective Particulars free. Wagoner, P-125 West 86th, N. Y. 24.

WATCHES, Elgin, Waltham, other outstanding brands. Expertly reconditioned, priced low for quick, great profits! Send for Free catalog. Plymouth Jewelry 163-P Canal St., New York 13.

SCHOOL Seniors—Earn sensational profits selling classmates America's Most Beautiful Graduation Name Cards. Largest selection. Outsells all others. Free sample kit. Printcraft, Dept. P, 1425 E. Elm Street, Scranton 5, Penna.

$10,800 PROFITS At Home! Lifetime Opportunity! Free advertising method builds your own Home Mailorder Business! Capital, experience unnecessary. Start spare time. No merchandise investment! No advertising risk! Exciting; practical, Copyrighted, notarized proven successful plan 25c. Satisfaction guaranteed! Treasury, 149 Storer, New Rochelle 3-P, New York.

BIG Profits. Make fast-seller chenille monkey trees, Christmas poinsettias, Santas. Literature free. Velva, Bohemia 17, N.Y.

ADJUSTERS Needed Now! Excellent high pay positions open with airlines, insurance companies and government departments. Send for Free book. Write Today. Universal Schools, P-122, Box 8202, Dallas 5, Texas.

$$$ IN Personalized Baby Record Books. Sell By Mail Use Same Literature We Do. No-Co-Ro, Oakland 6-P, Calif.

BE Appointed State Notary Public Now! Details; Stationers, Helotes, Texas.

START a profitable subscription business in spare time! We need men and women (young or old) as representatives for all leading national magazines. Liberal commissions paid for new and renewal subscriptions. Start earning money in this pleasant work at once! Clip this ad and send with your name and address to: International Circulation Division, Dept. PS, Hearst Magazines Inc., 250 West 55th St., New York 19 N. Y.

EARN Money Evenings, copying and duplicating comic cartoons for advertisers. Adservice, Argyle 2, Wisconsin.

PRINT Without A Printing Press. Big Money! See page 50.

100 WORKABLE home business ideas 25c. Schenck, W. Penn, Butler, Penna.

FREE, big opportunities mail. Mac's Service, 119 Vine, Shelbyville, Indiana.

BUY Wholesale thousands nationally advertised products at big discount. Sent free "The Wholesale Plan." American Buyers' Service, 627-S Linden, Buffalo, New York.

MAKE Ceramic articles for fun and profit. 50c for complete instructions and big illustrated catalogue. Refund on first order. Seeley's Ceramic Service, Livingston Manor, New York.

MAKE Money addressing Envelopes at Home! Our information reveals how. Only 30c. Business Bureau, Dept. 45-N, P.O. Box 2224, St. Louis, Mo.

$100-$200 WEEKLY. No selling or manufacturing. Part or full-time. Mahaffey, 3032-A Weldon, Los Angeles 65.

FREE Book "505 Odd, Successful Businesses." Work Home! Expect something Odd! Pacific-99B, Oceanside, Calif.

WIN contest money. General Contest Bulletin gives hundreds of tips. List current contests and rules. Sample 25c. General Contests, 1609-A East 5th, Duluth, Minnesota.

PLATING outfit, refinish metal parts, no tank required, information free. Norwood Plating Co., Norwood 2, New Jersey.

WE pay you highest rates for hand-decorating greeting cards. Work home. Experience unnecessary. No selling required. Greetings, 100 Madison, Detroit 26.

EARN $50 weekly spare time. Compile lists of names for merchants, manufacturers, dealers. Detailed information, including names of firms buying names, only 50c. Guaranteed satisfaction. Aaron's, 2507 South Bronson, Los Angeles.

39 FORMULAS, PLANS, ETC.

FORMULAS, trade secrets, for nearly everything. Catalog free. Creative Publishers, Winnetka 7, Illinois.

LATEST manufacturing formulas, for profitable, easy to make chemical specialties. Lists free. Automotive Chemical Laboratories, Box 393-B, Hicksville, N. Y.

ANY Formula $2.00. Satisfaction guaranteed. Jack, Chemist, 4292 Parkside, Philadelphia 4.

FORMULAS, latest. Catalog—Chemical Instruction Sheet 10c. Belfort, 216 West Jackson, Chicago 6.

FORMULAS—All kinds. Latest products. Literature free. Kemico, Park Ridge 15, Ill.

LABORATORY tested formulas. Lists free. Pont, Box 635-PS, Terre Haute, Ind.

EASY Laboratory Methods, authentic, reliable and practical Money-Making Formulas you can make in your own home. Soap—Cold Cream—Sunburn Lotion—Deodorant—metal polish—stain remover—pest exterminator. Ten Different Select Formulas of vital household and beauty products. All Ten for just $1.00. Forward to Cameo Smith Laboratories, Dept. A1, 6411 Hollywood Blvd., Hollywood 28, Calif.

FORMULAS for big-profit, fast-selling products. Free literature. Majestic, 530½ S. Main, Elkhart, Indiana.

40 PLASTICS

NEW liquid plastic. Clear, colors. Cast without heat. Embed flowers, insects, coins. Saw, drill, carve. Send 25c for Wholesale Catalog and New Sales Manual showing how to make money at home. Castolite, Dept. P-102, Woodstock, Illinois.

HI-Profits—Gifts—Jewelry—Free catalogue, details. Pilot Plastics, 67-B Fulton St., New York City 38.

PLASTIC Sheets, Rods, Tubes, etc. Free List. Plastic Supply Co., 2901 N. Grand Blvd., St. Louis 7, Mo.

Copyrighted material

LUCITE. Plexiglas. Any size sheets masked Square foot (12 x 12) cost 1/16" $1.20; 1/8", $1.40; 3/16", $1.75; 1/4", $2.08. Include 10% postage. Almac Plastics. 230 Fifth Avenue. New York 1. New York.

PLASTICRAFTERS supplies wholesale. Literature 20c. Cosmopolitan, Box 176-PS, New York 8, N. Y.

PLASTIC Sheets, low prices. Instruction Manual, complete catalog, 50c postpaid. Plastic's, Box 1812, Salt Lake City 10, Utah.

LUCITE, Plexiglas, acetate; casting, molding plastics, findings. Dye manufacturer. Quantity prices. Special bargain lots. Immediate shipment. Complete catalog 10c. 25c airmailed. Gem-O'-Lite, Box 6864, North Hollywood, Calif.

LEARN plastics at home. Small cost—spare time. Dime brings sample plastic, three experiments, full details. Plastic Projects, Box 5151, Detroit 35, Mich.

IT'S fun! It's easy! It pays! Write Plasti-Kit, Box 457, Algonac, Michigan.

41 CHEMICALS & APPARATUS

NEW Idea Chemical and Apparatus Outfits for Home Experimenting. Photo-Scales, Microscopes, Chemicals, Biological and Laboratory Supplies in Small Quantities. Catalog 25c. Established 1931. John H. Winn. 124-B West 23rd Street, New York 11, N. Y.

LUMINOUS Paints will glow in dark. Six colors. Fairmount Chemical Co., 136 Liberty St., New York City 6.

LABORATORY Apparatus, Chemicals, Microscopes. Complete Chemistry Sets, Minerals, Uranium Ore. 10c brings catalog. Porter Chemical Company, Hagerstown 2, Maryland.

SPECTROSCOPE for quick chemical analysis $3.00. Cutting Sons, Los Altos, Cal.

ILLUSTRATED Catalog: Chemistry, mineralogy, biology. 10c. Tracey Laboratories, Evanston, Illinois.

OH Boy! New Book of Science, Experiments, Formulas, Secret Processes, together with Catalogue of Laboratory Supplies, only 25c. National Scientific Company, Dept. 15, 2204 W. North Avenue, Chicago 47, Illinois.

CHEMICALS and apparatus for industrial, analytical, and private laboratories. Catalog 20c. Dept. M-26, Biological Supply Co., 1176 Mt. Hope Ave., Rochester 20, N.Y.

SAVE Money! Supplies Catalog 15c, refundable. Laboratory Sales, Box 161, Brighton, Mass.

CATALOG of chemicals, apparatus, kits, minerals, Uranium ore. 10c. Rex Laboratories, 2849-B Birchwood, Chicago 45, Ill.

42 HELP WANTED

FOREIGN & Latin American Employment. 1951 "Foreign Service Directory" gives Up-To-Minute Facts on Military & Civilian Construction, Government Jobs, Major Oil Listings, Aviation, Transportation, Steamship Lines, Mining, Importers, Exporters, How-When-Where to apply, application forms, Hot List Firms Hiring. $1.00 post-paid. Global Reports, P.O. Box 883-S, Hollywood 28, Calif.

FOREIGN Job. Contracts underway and soon starting in Africa, South America, Canada, England, Europe, South Pacific, Middle East, Mexico and Alaska. Send $1.00 for foreign job news, information, application forms, etc. DCS Foreign Job News, Dept. 268-DF, Bridgeport, Ill.

FOREIGN Employment Construction men, building trades, helpers, office men, others, interested in Foreign Projects. High wages, quarters, trans. Listings of firms actively working on U. S., Foreign, Intercontinental Projects. Send $1 for Foreign Construction Compendium and Application Forms. Foreign Service Bureau, Dept. PS-12, Box 295, Metuchen, New Jersey. (Not an employment agency—no fees.)

WANTED: Women to earn money addressing postals. Details 25c. L. Behnke, Guttenberg, Iowa.

$1,000,000 CONSTRUCTION Projects, "World Wide" printed Monthly Foreign & Domestic employment. Free application blanks tells How-When-Where to apply. $1.00 complete. Global Reports, P.O. Box 883-PX, Hollywood 28, California.

CONSTRUCTION Workers. Want to make better jobs? Longer jobs? Latest information. Jobs breaking. Jobs underway. North, South, East, West. The best. Big job list. Accurate. Up to date. Send one dollar. Dempster's Construction Scout News, Dept. 268-DE, Bridgeport, Ill.

43 AGENTS WANTED

BUY wholesale 25,000 items, catalogue 25c. Matthews, 1472-A5, Broadway, N.Y.C.

NEW Jobs open in selling! Send name, address for five free issues of Opportunity Magazine's money-making guide, listing hundreds of companies who'll pay you well, full or part-time. No experience needed. Opportunity, 28 E. Jackson, Dept. 18, Chicago 4, Illinois.

DRESSES 18c; Coats $2.00; Blouses 35c; Free Catalogue; Crown, 164-PB, Monroe Street, New York 2.

NEED Extra Cash? Take orders for personal initialed belts and buckles, cap badges, tie holders, etc. Choice of 3000 emblems. Free sales kit. Hook-Fast, Dept. 1425PS, Providence, R. I.

MAKE Wedding Profits. Sell invitations, napkins, matches. Samples free. Dunbar's, Middlebush 5, N. J.

AGENTS—300% profit selling genuine gold window letters; stores and offices. Free samples. Metallic Letter Co., 437 N. Clark, Chicago.

COMMERCIAL Deep Frying Course. Mock Chicken Legs, Potatoes. New and proven methods. Learn about this money-making field. $2.50. PP. Concession, Toledo 13, Ohio.

START Your Own Business on credit. Always your own boss. 1,437 Dealers sold $5,000 to $28,500 in 1950; their average $6,704. We supply stocks, equipment on credit. 200 home necessities. Selling experience unnecessary to start. Wonderful opportunity to own pleasant, profitable business backed by world-wide industry. Write Rawleigh's, Dept. L-U-PSC, Freeport, Ill.

IS $210. a week worth a penny postcard to you? Then rush card with name and address for special Free Trial Plan that sells amazing new Automatic Refrigerator Defroster "like hot cakes!" Write to Mr. Lewis, D-Frost-O-Matic Corp., Dept. C-103, 6 N. Michigan, Chicago 2, Ill.

CHRISTMAS Cards At Jobbers Prices! Large selection dollar assortments 35c each in hundred lots. Imprint Cards, Money Folders, Gift Cards, Pictures, etc. Make more profits selling our line! Catalog free! Three sample boxes $1.00. Elfco, 438 North Wells, Chicago 10.

BE A Money Maker . . . Represent magazines year around. Wonderful home work. Big Christmas profits now. Liberal commissions. Everything furnished. Write for Free catalog. McGregor Magazine Agency, Dept. 510A, Mount Morris, Ill.

GOLD Lacquered and Silver Sign Letters. Windows. Doors. Trucks. Standard sizes. Penny each. Free samples. Atlas-G, 544 West 79th, Chicago 20.

SCHOOL Seniors! A postal will bring you our wonder, Kwick-Sell Cardalog of popular Graduation Name Cards. Biggest profits! Only firm giving free Golden Memory Book and Souvenir Chest. Don't miss out. Hurry that postal! Craftcards, Box 235 (m), Pittsburgh 30, Pa.

HI-Profits—Gifts—Jewelry—Free catalogue, details. Pilot Plastics, 67-B2 Fulton St., New York City 38.

WHERE to Buy 800,000 articles direct from Manufacturers. Save by buying direct. Sent Free. "Your Profits Under The Spotlight." Glass Pub. Co., Ellwood City 4, Pennsylvania.

PRINTING — Salesbooks — Envelopes — tags. Free illustrated catalog. Ersco, 1937 Patterson Ave., Bronx 72, New York.

"FOG-Stop" Windshield Cloth. Instantly removes blurry Mist, Frost, Sleet, Snow. Stops windshield fogging. Samples sent on trial. Kristee 139, Akron, Ohio.

FAST sellers. Big demand. Catalog. Parker Drug Co., Hoboken 6, New Jersey.

MAN to earn $100 week up. Long needed invention. Advertised Saturday Evening Post, Colliers. Prospects everywhere. Full or part time. Exclusive. No investment. Free samples. Write Red Comet, Inc., Dept. 57-A, Littleton, Colorado.

STRANGE "Dry" Window Cleaner. Sells like wild. Replaces messy rags, liquids. Simply glide over glass. Samples sent on trial. Kristee 138, Akron, Ohio.

"ADVANCE Commissions — Addressing Envelopes!" Homework! Instructions, 25c! Hirsch, Spring Valley 3, New York.

EXTRA money quick. Sell "NuSilver Polish and Plating Liquids." Cloth applied. Particulars free. NuSilver, 508-PS12, New York St., Aurora, Ill.

CALENDARS, Advertising Novelties, Matches. All styles, including Religious. Varnished. 12 Sheet. Girls. Hundreds of Advertising Novelties. Book Matches, etc. Fleming Calendar Co., 6539 Cottage Grove, Chicago 37, Illinois.

ULTRA-Blue Stock Signs—7c. Sell 35c. 2,000 slogans, 7"x11", comedy, religious, general. 15 samples. $1.00. Lowy, 812-SD Broadway, New York 3.

BIG Daily Profits—selling embroidered wool and cotton uniforms, initialed buckles, belts, badges, choice 3,000 emblems. Free sales kit. Hook-Fast, Box 480PS, Roanoke, Va.

NICKEL Silver key checks—Key check stamping Outfits. Catalog free. General Products, 11PS, No. Pearl, Albany, N. Y.

BEAUTIFUL hand made Lapel Pins. Gold or Chrome initials on imported wood backs $1.00 each; agents wanted. Rice, 2439 N. Francisco, Chicago 47, Ill.

UP to $50.00 in a week spare time and tailored suit for yourself without paying one cent. Write for plan and Free Sample Case. J. C. Field, Dept. A-1721, Harrison & Throop, Chicago 7, Ill.

HOW would you like to get paid for "giving away" first quality nylon stockings at 49c? That's all they cost if they run within guarantee period to three months! Advance cash—big bonus. No experience needed. Just write orders. We deliver—collect. Postcard brings you free sample stocking and sales outfit prepaid. Kendex Corp., Babylon 34, New York.

SELL Big Money-Maker to Men and Women. Easy handwork makes fast-selling useful articles. Sample free. Sunmade Company, Brockton 64, Mass.

ABSOLUTELY Free! Big package actual sample fabrics and style presentation of dresses, lingerie, hosiery, etc. Take orders. Commissions big. Send no money. Melville Co., Dept. 6541, Cincinnati 25, Ohio.

FREE Samples, and amazing plan giving you gorgeous Dress without penny cost. Rush name today, with dress size. Harford, Dept. G-135, Cincinnati 25, Ohio.

FREE book "505 Odd, Successful Businesses." Work Home! Expect something Odd! Pacific-97B, Oceanside, Calif.

NYLONS, amazing get rich quick, 100% bonus offering. Essential Products Co., 210 Fifth Ave., New York 10, N. Y.

SALESMEN, Distributors, fast selling costume jewelry direct from factory. Big picture catalog free. Pickcraft, C-19 Bank, Attleboro, Massachusetts.

LUNCH Counters want "Wishing Well". Collects coins galore. Your cost: $59.40 dozen (sample, $7.50) prepaid. Sell $10.00 each. Industries 24, Box 929, Long Beach 1, California.

SELL Holiday sparkling sign to stores; Xmas money quickly; 10 samples $1.00; Byron Co., Clinton, North Carolina.

MEXICAN feather pictures. Sell on sight; 200% profit! Free details; sample 10c stamps. Sylvia-SS, Apartado 9036, Mexico City.

BUY Wholesale thousands nationally advertised products at big discount. Sent free "The Wholesale Plan." American Buyers' Service, 629-S Linden, Buffalo, N. Y.

SELF-Propelled rotary mowers. 20"-32". All purpose. Extra discount—now. Farm Products-PS, Excelsior Springs, Missouri.

44 HIGH-GRADE SALESMEN

MAKE money showing neighbors how to beautify yards with glorious flowering shrubs and trees. Quick-bearing Dwarf fruit trees; World-Famous Stark Patented Varieties produce abundant harvests champion-quality apples, pears, peaches, other fruits. Even small plots produce fruit for family-use and to sell. Beautiful Sales Kit Free. Stark Bro's., Dept. 30162, Louisiana, Missouri.

WRITE 3 Words—Collect $7.65 on 10-second Demonstration to merchants—write on glass with Amazing Magic Crayon—Presto!—5-color advertising message takes fire—glows like brilliant Neon. Three sales daily bring $22.95 profit. Rush postcard for details.—Complete Sales Kit, Free! Maxilume Co., 125 W. Hubbard, Dept. CL-912, Chicago 10, Illinois.

ADVERTISING book matches—Cash in on big demand—sell Union Label matches. Cuts for all businesses and political parties—Free powerhouse selling kit—low prices—protection guaranteed on repeat orders—Cash commissions. Superior Match Co., Dept. P-1251, 7530 Greenwood, Chicago.

AD Matches! Sell Amazing Designs—20, 30, 40 and 240-light book matches. Biggest spot cash commissions; every business a prospect. Low prices for high quality. Repeats. Start without experience; men, women; full, part time. Buy Nothing! Sales kit furnished. Match Corp., Dept. PS-24 Chicago 32, Illinois.

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EARN Big Money Fast! Sell finest-quality advertising work uniforms to garages, factories, filling stations, etc. Free selling kit. Topps, Dept. 5412, Rochester, Indiana.

GOOD-Bye "Hangover Blues." Hello Season's Biggest Profits! Exclusive territories available to men who can qualify. New, revolutionary, non-competitive product developed specifically to rid the nation of its number one malady, "Hangover Blues." Sells in Drug, Cigar, Sundries, Liquor Stores, Taverns, Hamburger Spots, Super Marts, Factories, Newsstands, Roadhouses, Night Clubs, Cocktail Lounges, etc. Nationally advertised. Stade comes in 25c and $1.00 sizes. Send $1.00 for samples and full Big money-making details—or write today for details only! United Pharmacal Products, 176 W. Adams, Dept. 1A, Chicago 3, Ill.

45 EDUCATIONAL & INSTRUCTION

USED Correspondence Courses and Books sold and rented. Money back guarantee. Catalog free. (Courses Bought). Lee Mountain, Pisgah, Alabama.

BOOKKEEPERS! Increase your earnings! Operate your own simplified "Dollar-A-Week" Bookkeeping and Tax Service. Full or spare time. Details Free. No obligation. Ellis, Box 203-N, Cedar Grove, N.C.

START a Collection Agency business. Very profitable. Quickly learned. Write Cole & Associates, Syracuse 2, N. Y.

MEDICAL Laboratory Technicians in great demand. We train you in your own home. Catalogue free. Imperial Technical Institute, Box 973-B, Austin, Texas.

LEARN Piano Tuning, Repairing—at home in 30 days. Unlimited income. Phonograph recordings, tools and instructions furnished. Write Capitol City Tuning School, Department C-1233, 129 East Michigan, Lansing 16, Michigan.

USED Correspondence Courses, Bought, Sold, Rented. Free list. Home-Study, 408 North High, Salem, Indiana.

"DYNAMIC Mind-Power" Directs your Powerful Sub-Conscious Mind to bring you Positive Personal-Success! $1.00 Psychology Publishing Co., 673 S. Coronado St., Los Angeles 5, Calif. Dept. P.

DO you want Big Money? Men-Women adjusters needed by airlines, steamship lines, insurance companies. Qualify now. Many earning up to $125 week. Free book. Write today. Universal Schools, P-142, Box 8202, Dallas 5, Texas.

MIDLAND Linotype School, Charles City, Iowa. Civilian, Veteran courses. Free placement.

PIANO Tuning Pays. Learn this profitable profession at home. Our Tonometer and mechanical aids make learning easy. No knowledge music necessary. Diploma granted. Largest and oldest school—51st year. G. I. Approved. Write for booklet. Niles Bryant School, 77 Bryant Bldg., Washington 16, D. C.

COCKTAIL Lounge Bartending and Management. Home study or School Training. American Bartending School, P-334 S. Wabash Avenue, Chicago 4, Illinois.

TIRED Of No Money, second rate jobs? Like to start a real career with a lifetime of high salaries Write me about two growing fields that really need men. Ed. Howes, Chief, National Schools, 4000 S. Figueroa Street, Los Angeles 37.

PRACTICAL Nursing—Learn Easily at Home, Spare Time. Big demand, good earnings. High School not necessary. Write for free facts. Wayne School, Dept. FH-5, 2525 Sheffield, Chicago 14, Ill.

BECOME a Doctor of Psychology or Metaphysics. Teach secret of contentment, happiness. Win degree of PsD. or MsD. Solve mental worries. Free book. College of Universal Truth, 5153-K N. Clark, Chicago.

SMASH worries, fears and problems. Wake up your mind with our home-study Behavior Control Plan. Be what you desire. Many helped. Rush request for amazing free lecture. Personal Psychology, Inc., Box 1924-S, Louisville 1, Kentucky.

WELDING training pays at Hobart Welding School. Box P-1212, Troy, Ohio. VA Contract. Best equipment. Catalog Free.

EARN more money by improving your mathematics, details free. Page Publications, McFarland, Wisconsin.

USED Correspondence Courses and Educational Books Bought, Sold, Rented. Catalog Free. Educational Exchange, Summerville, Georgia.

STUDY for game warden, park, forestry, and patrol service. Write Delmar Institute, D16, Whittier, Calif.

INCREDIBLE! Unprecedented! Look under "Personal!" Bijou, Box 1727-K, Hollywood 28, Calif.

JOIN "Success Anonymous". Local Club. Social, Educational, Fraternal. Write: Ben Martin, Williamsburg, Michigan.

$50.00 MAY be earned daily as Income Tax Consultant. Details without obligation. Universal, Box 664-P, Springfield, Mo.

"25 LESSONS in Hypnotism". Amazing —Instructive—Amusing. 50c. Stowell S, Woodstock 4, New York.

46 CONTESTS

TIE-Breaker picture puzzles exposed, $1.00. Winograd, Box 1495, Philadelphia 5, Penna.

47 DETECTIVES

DETECTIVES—Work home—Travel. Experience unnecessary. Detective Particulars free. Write, Wagoner, P-125 West 86th, New York 24.

DETECTIVE Training. Phillips Secret Service System, 1917-C North Kenneth, Chicago 39, Ill.

DETECTIVES needed in every town. Hanna, 8118 Fielding, Tampa, Florida.

48 LANGUAGE OUTFITS

LISTEN and Learn A Language by Linguaphone. At home, quickly, easily, correctly master Spanish, French, German, Russian, Asiatic—any of 29 languages through Linguaphone Conversational Method. Add to service, job, travel opportunities. Send for Free book. Approved for Veterans' Training. Linguaphone Institute, 5412 Rockefeller Plaza, N. Y. C.

50 BUSINESS SERVICE, INFORMATION, NAME LISTS

1,000 NAMES, up to date list, Opportunity Seekers Mail Order Aspirants $1.00 Postpaid. G. & G. Products, Box 7, Planetarium Station, New York 24, N. Y.

NEW U. S. Juvenile lists on gummed labels $10—M. 10M—$85; 25M—$175. Postpaid. Teenames, 1553 S. Stanley, Los Angeles 19, Calif.

51 SPECIAL SERVICES

PHOTOS encased in plastic. Up to 3x5, four $1.00. Sealview, Wayne, Penna.

FINE dividends? Double $200 or more? For answers write Ivar Blomberg, Alanson, Michigan.

52 AUTHORS SERVICE

"TEN Steps To Writing Success" reveals How you can write stories, poems, articles for publication. Details Free. Will Herwell, 7016 Euclid, Cleveland 3, Ohio.

I Want New Writers. Experience unnecessary. Earn at home, spare time. Details Free. Saunders M. Cummings, 468-15 Independence Bldg., Colorado Springs, Colo.

LOOKING For A Publisher? Write for free booklet PS1. Vantage Press, 230 West 41st, New York.

53 ADVERTISING

ADVERTISE: 24 words, 40 Newspapers. $3.50. Lists Free. Advertising Bureau, 10511-P Springfield, Chicago 43.

500 CIRCULARS mailed first class mail $1.00. Israel Company, Dept. 15, 6051, Washington 5, D. C.

ADVERTISE at no cost. $4,000 sales from Free ads. Publicity Advertising, 1501 Trails End, Kalamazoo, Michigan.

54 CARTOONING, SIGN PAINTING, CHALK TALKS

"HOW To Make Money With Simple Cartoons"—A book everyone who likes to draw should have. It is free; no obligation. Simply address Cartoonists' Exchange, Dept. 1912-C, Pleasant Hill, Ohio.

BE smart get in art. I'll start you free. 25 years experience. Nick Nichols Arts, 39 West Adams, Chicago 3, Ill.

CHALK Talks. Laugh Producing Program. $1.00. Illustrated Catalog 10c. Cartoonist Balda, Oshkosh, Wisconsin.

55 TYPEWRITERS & OFFICE MACHINES

PRINTOMATIC selfieeding Post Card printing Duplicator $15.75. Envelope Addressing Machines $24.50. Pittsburgh Typewriter Company, 336-G Fourth Avenue, Pittsburgh 22, Pa.

ROTARY stencil printing machines, $24.50 up. Mechanical addressers $10.95 up. Duplicator, addresser, office supplies. Dorsett, 2217B So. Walnut, Muncie, Ind.

TYPEWRITERS $22.50, Adders Duplicators $13.50 Typewriters, 118 Spruce, Wichita 7, Kansas.

ADDING machines, typewriters, new portables, office size typewriters wholesale. Enclose 10c for catalogues. Apple, 993A Westchester Ave., New York City 59.

56 RUBBER STAMPS & OFFICE SUPPLIES

3 LINES 50c; Pads 35c; Signatures $2.00. Printright, Wauwatosa, Wisconsin.

LINE 25c; 2-45c; 3-65c. Stamp Shop, Auburn, Nebraska.

57 PRINTING, MULTIGRAPHING, ETC.

QUALITY Printing. Booklets, publications, circulars, stationery. Free price list. Adams, 30 West Washington, Chicago 2, Ill.

1,000 BUSINESS cards $2.35. Prepaid. Other printing. W. Dornfeld, Iron Ridge 6, Wisconsin.

PRINT Without A Printing Press. Big Money! See page 50.

BUSINESS Printing. Samples, prices free. Howprint, 723-S Eunice, Webster Groves 19, Missouri.

PRINTING—Business, advertising, publication. Prompt, low quotations. DYarmett Printing, Newark, Ohio.

1000 BUSINESS Cards $2.50 Prepaid samples Free. Reliable Print Shop, 905 East Jefferson, Louisville 6, Ky.

PRINTING—5000 5½ x 8½ Circulars $18; 3¼ x 5½ $8.25; folders, books, everything. Garrison Press, Harrisonburg, Va.

58 PRINTING OUTFITS, SUPPLIES

PRINT your own cards, stationery, circulars, advertising. Save money. Simple rules. Print for others, nice profit. Raised printing like engraving too. Have home shop. Details free. Kelsey Presses, L-8, Meriden, Connecticut.

PRINTING Presses, Type Supplies. Lists 3c. Turnbaugh Service, Loysville, Penna.

MAKE your Own, self-molding, rubber printing cuts. Plexirubber, Argyle 2, Wisc.

PRESSES, Supplies, Paper, catalog 10c. Custom, Box 211-S, Springfield, Missouri.

AUTOMATIC mimeographs, original factory cartons, quantities $15.80. Electro-Aid, Hopkins, Minn.

59 PATENT ATTORNEYS

INVENTORS: Write for free brochure "Evidence of Invention." Labiner, World Building, New York 7.

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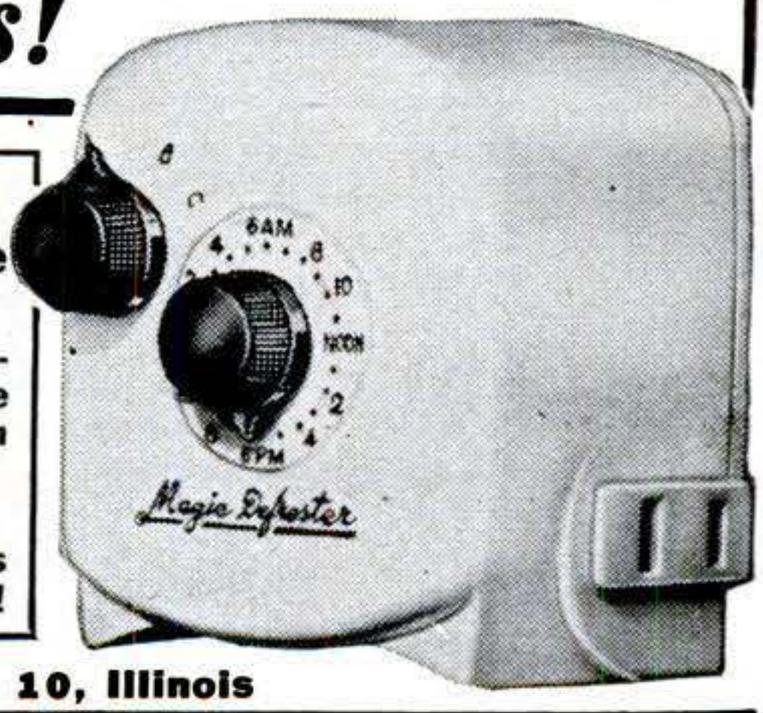

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Reduce engine wear, get quick starts all winter with a G.E. Calrod. Safe. Fits all cars. Attaches to water hose. Easily installed. Use any AC outlet. Engine warms quickly. Won't overheat. Not affected by Anti-Freeze. Kit includes pre-warmer unit & 2 cord sets. State make and model car (Chevrolet's $9.95) ALL OTHERS $8.95 p.p.

COAST AUTO SUPPLY, Dept. P.S. 121, 110 N.W. Broadway, Portland 9, Oregon

Money back guarantee. Send check, cash or M.O. (COD's send $1.00, you pay postage.)

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Test & improve your voice, playing; thrill & fool friends. Do acts, surprise programs, imitate Crosby or Hope, announce games & events, be disc jockey, etc. Practise broadcasting, be popular. Educational, over 100 practical uses. Users say: "Riot of fun—many other uses too!" "Bargain—does the work of $50 unit."

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—Jokes, Party Fun, Home Entertainment
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Use with 1, 2 or more radios for powerful public address system, music amplifier, etc. Use to overhear private conversations, baby or burglar alarm. Used by show barkers. **Talk as you walk! Improve personality! Speak better! Sing & Play better!** Learn techniques worth many dollars. **Do "fake" broadcasts.** "Call all cars!" Used for home, school, games, office, shop, etc., etc. Wonderful for announcing games, events, etc. Saves you time & money! Even make money renting it out for games, parties, dinners, speeches.

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Use It Anywhere! Broadcast to Car & Portable Radios Too! $8.98 Complete!

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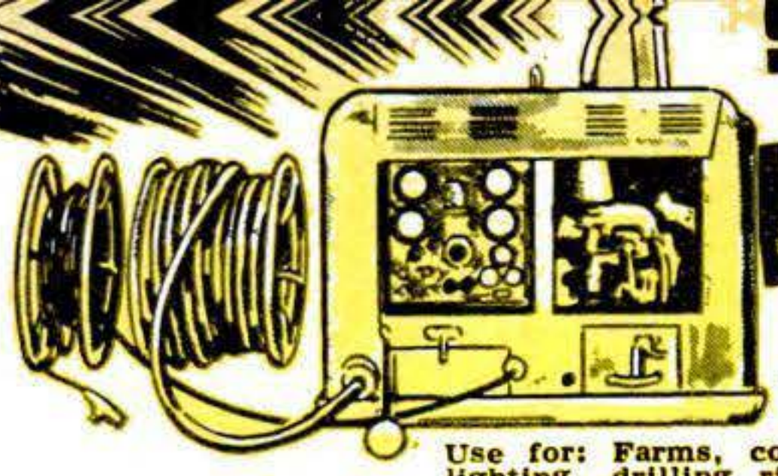

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LIGHT PLANT BUYERS in emergency telephone collect—unit shipped same day!

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1000-2000 WATT 110 v. AC **$194.00**

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To make plant 110-220 add **$40** for transformer.

2500-3000 WATT 110 v. AC, 60 cycle, Leland generator, runs at slow speed (1800 rpm) for longer life, 8.25 HP Briggs & Stratton gas engine. You can rely on this plant for all average home needs—freezer, stoker, pump, hot plate, radio, etc., and overloads from starting motors. Reconditioned and fully guaranteed.. **$295.00—NEW..$345.00.** Plants, same as above, built in 1951, with tools and spare parts. Lists at $790.00. Our price **$426.00**

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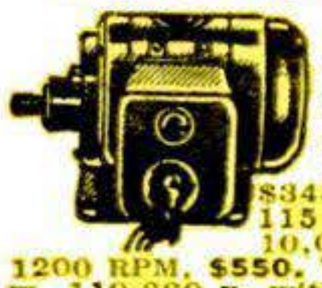

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300 Watt, RPM 3400, 110 and 220 v., ½" shaft, **$40.00.** 2500-3000 Watt, RPM 1800, 115 v. AC, **$225.** 3000 Watt, RPM 2800, 110 v. DC, Delco ball bearings, 1" shaft. List $343. To you at only **$99.** 5000 Watt, 115 v., RPM 1800, single phase **$259.** 10,000 Watt, 110-220 v., 60 cycle, 1200 RPM, **$550. TRACTOR DRIVEN GENERATOR** 2500 w. 110-220 v. with Floating mount to keep belts tight **$287.** Generator only **$235.**

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(Nothing less than 50 ft.)

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18 Inch

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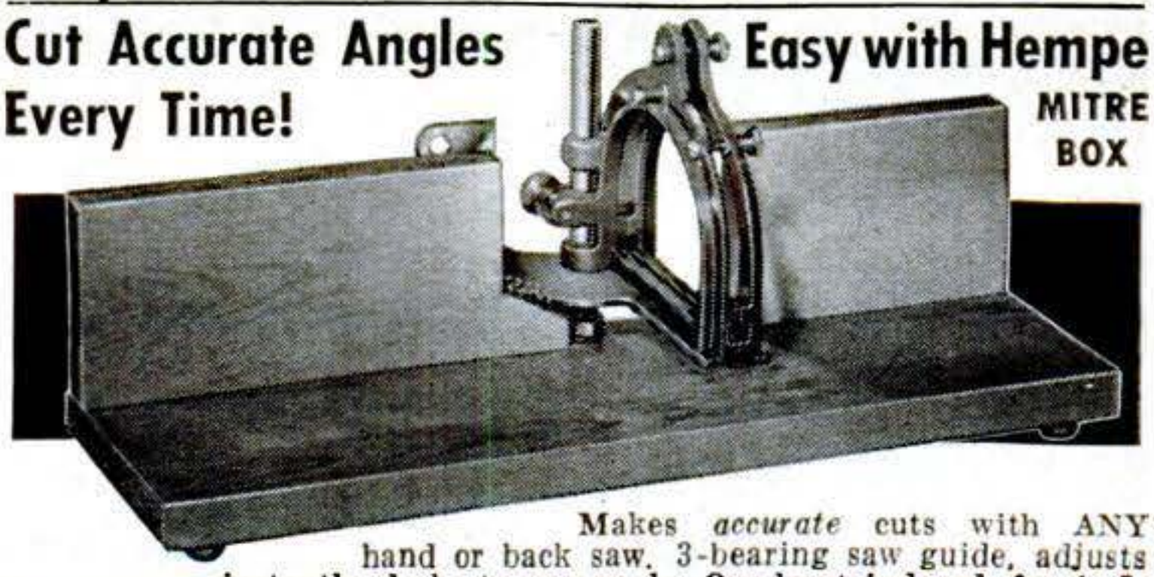

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Warms up fast—just the thing for heating trucks, buses, garages, etc. Has an output of 50,000 BTU'S per hour. 24 v. DC. Length 23", diameter 13", wgt. 14 lbs. Original cost $130. Special, NEW **$19.95**

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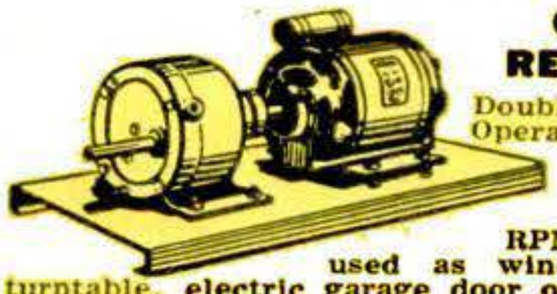

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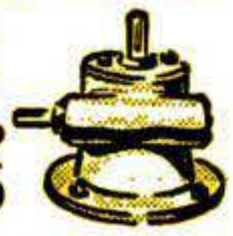

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2 HP	50 gal. tank	295.00
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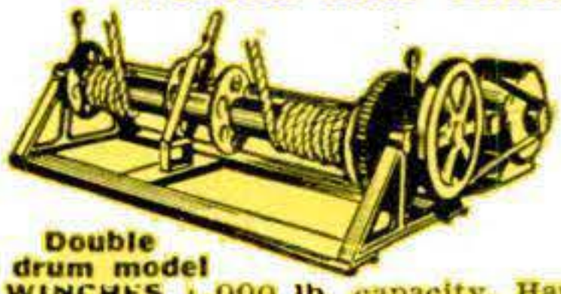

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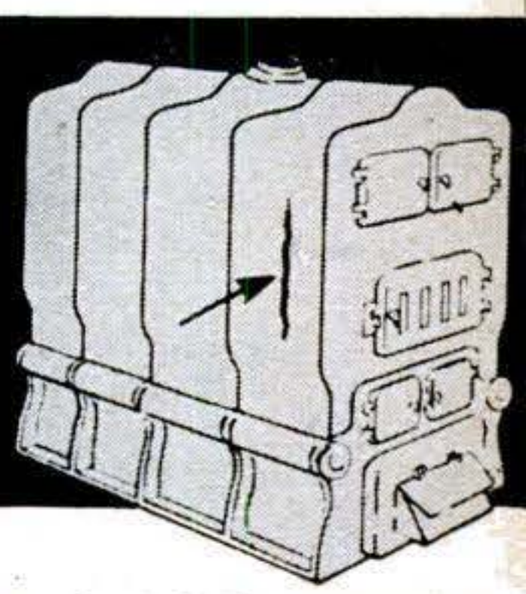

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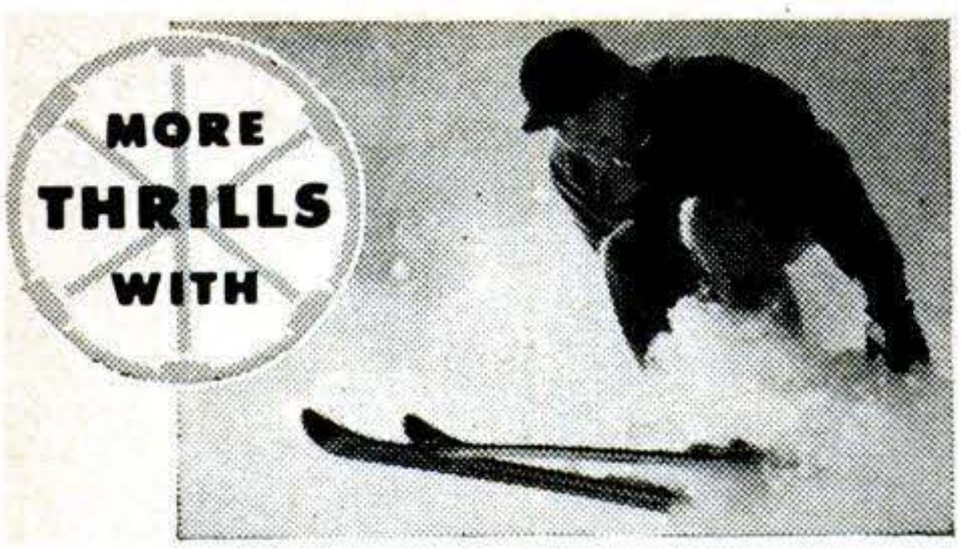

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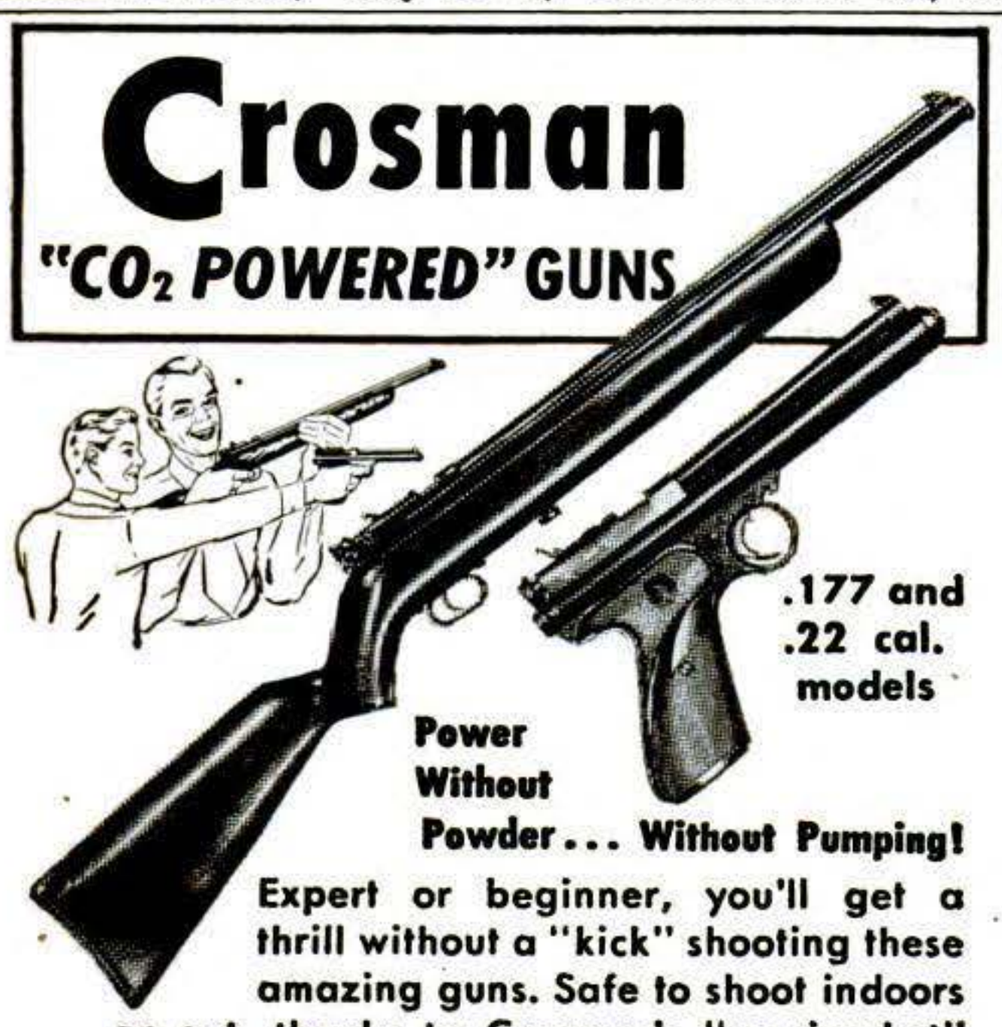

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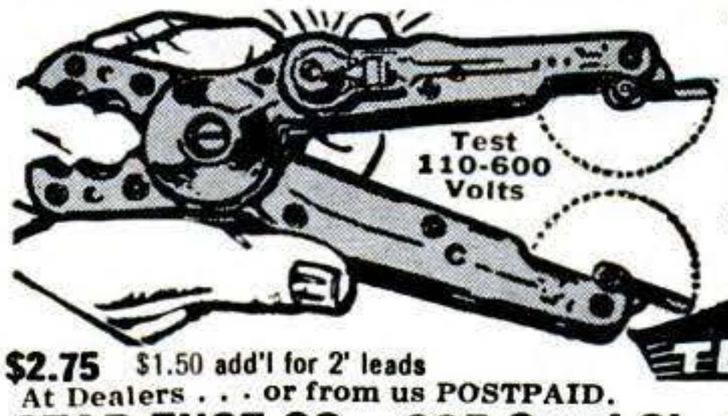

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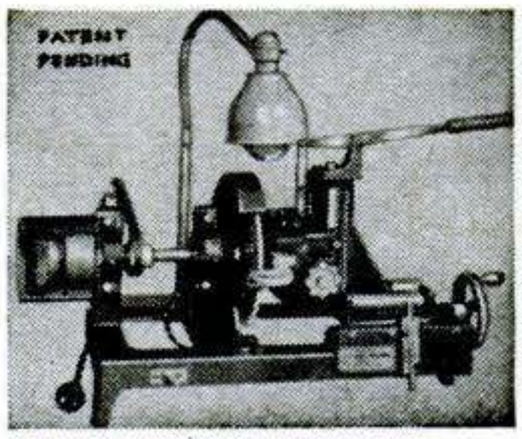

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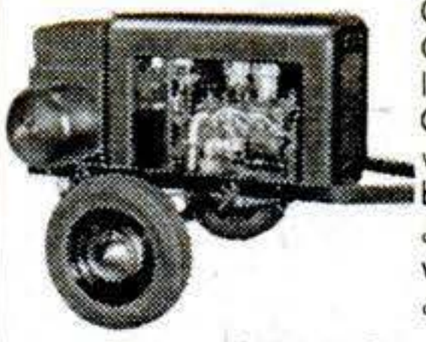

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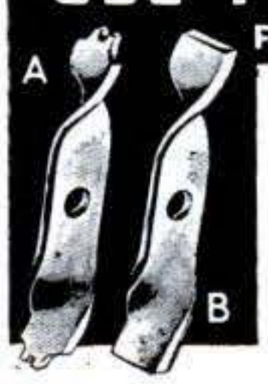

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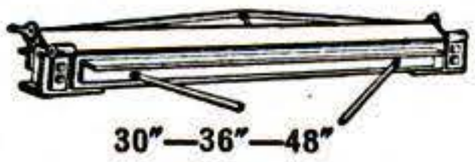

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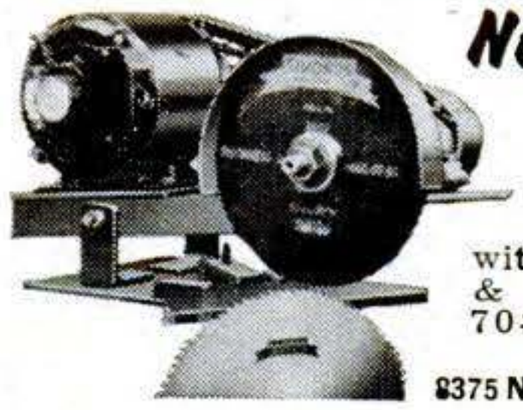

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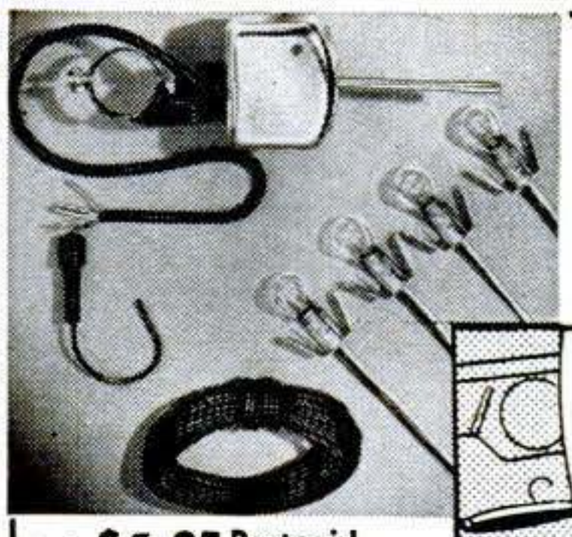

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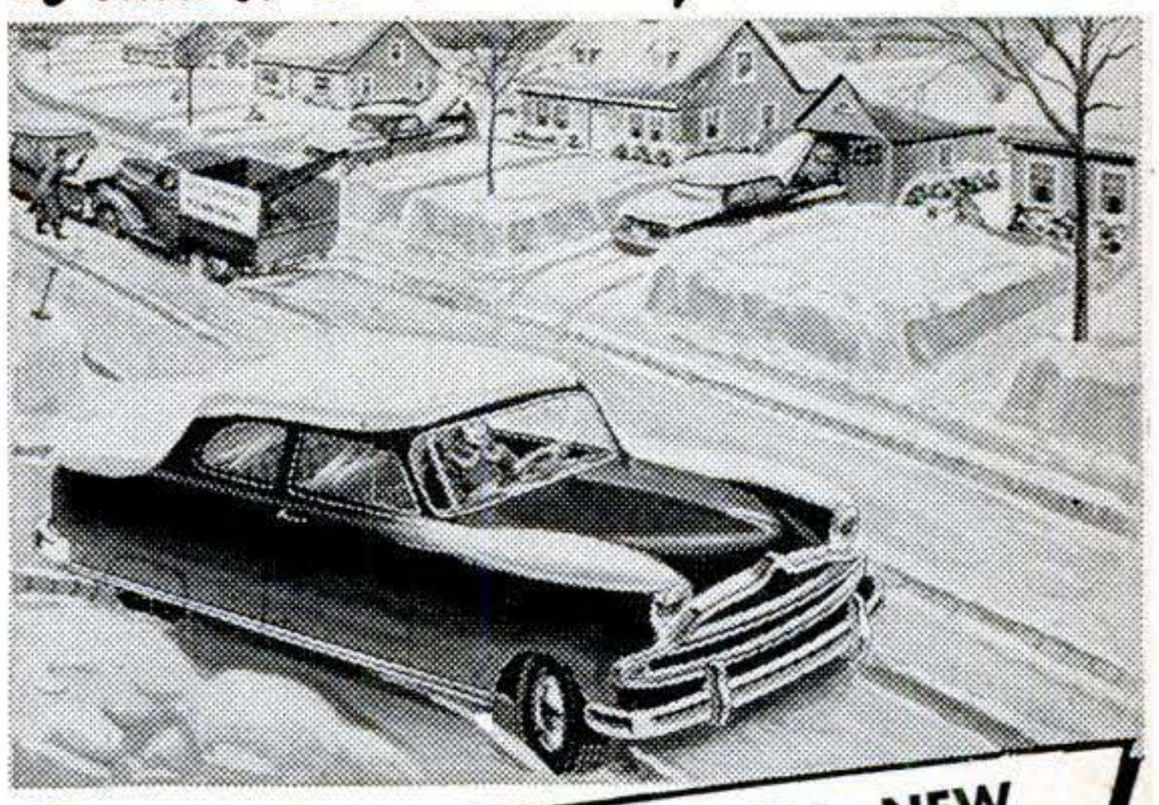

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Widely acclaimed by automotive engineers, Redi-Warm is a marvel of simplicity. It consists of only three small units — a thermostatic control which clamps easily to the engine head; a neutral switch which permits Redi-Warm to operate only while the car is in neutral; and a dash switch with which to put Redi-Warm in operation.

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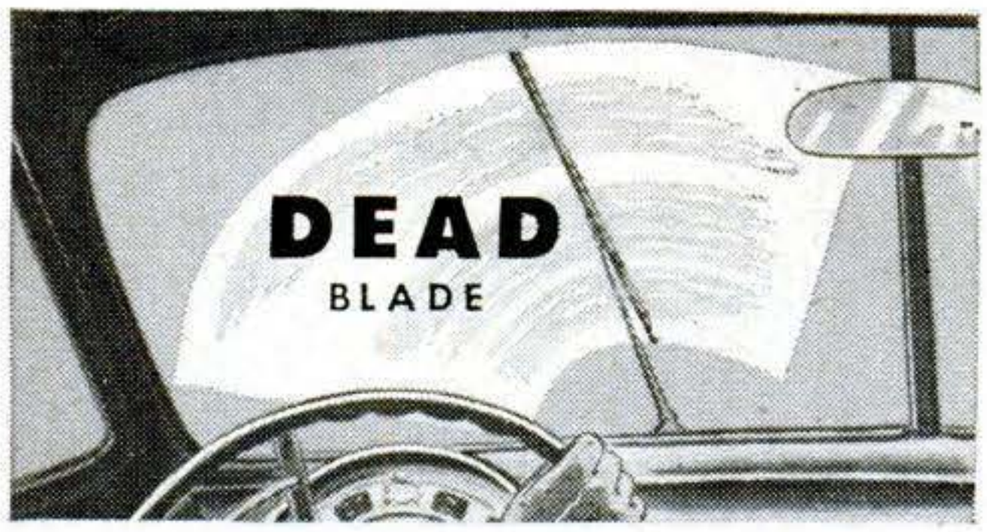
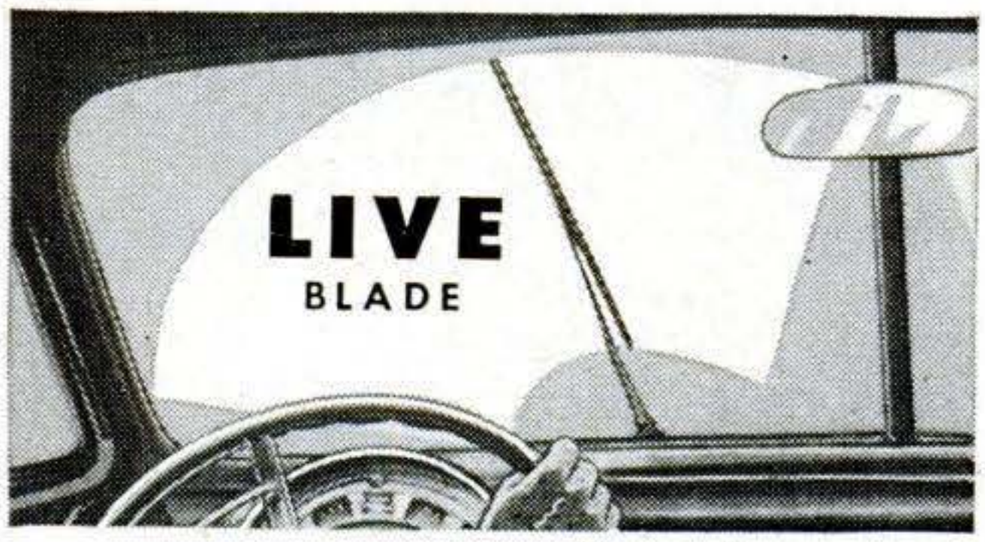


THIS DEAD WIPER BLADE still may look okay but it streaks glass dangerously. DEAD blades make DEAD drivers!



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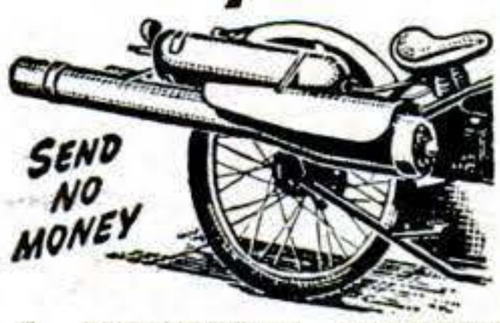

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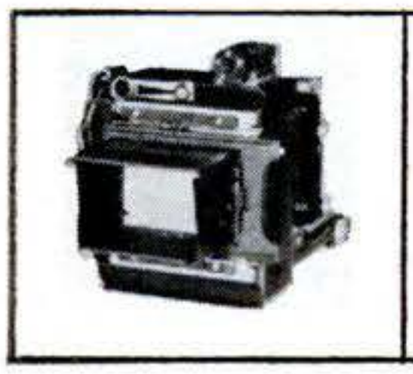

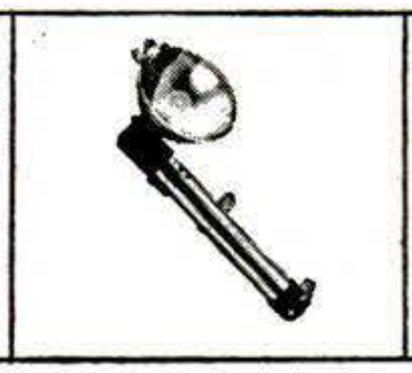

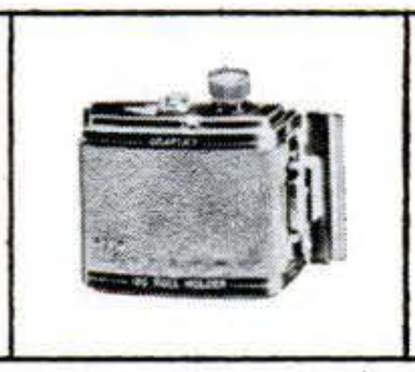

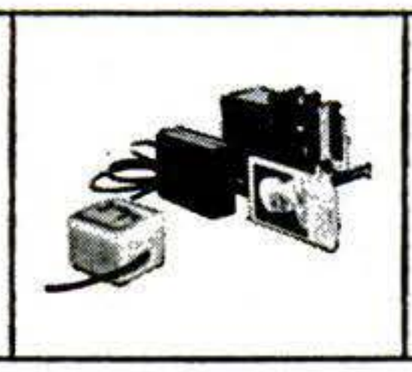

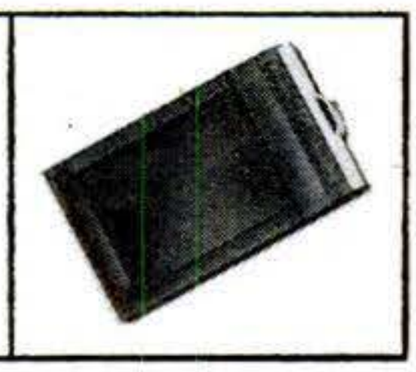

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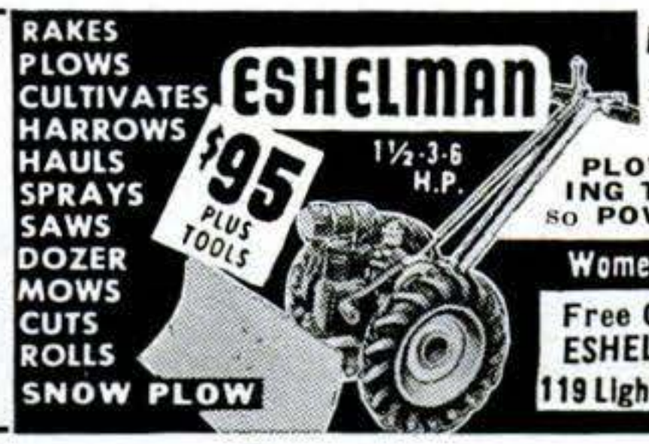

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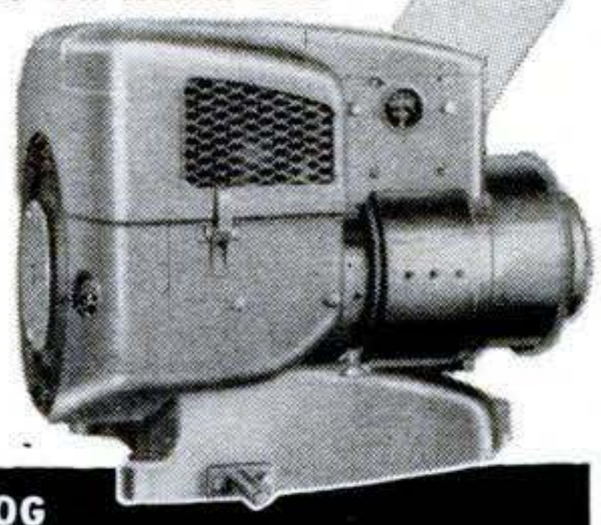

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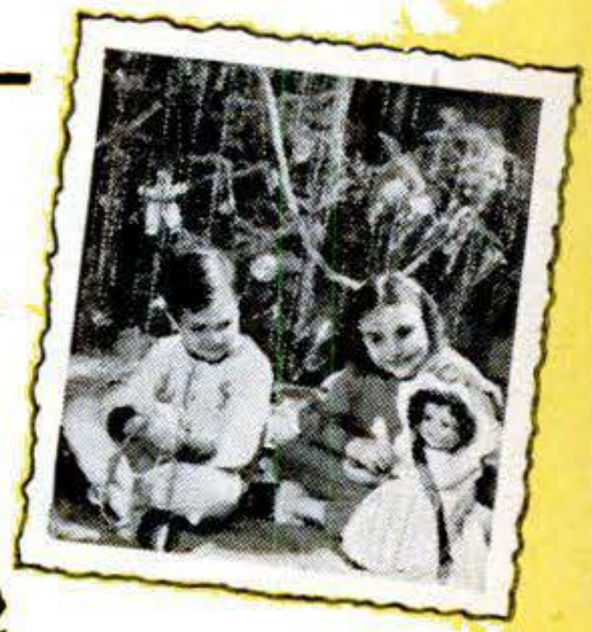

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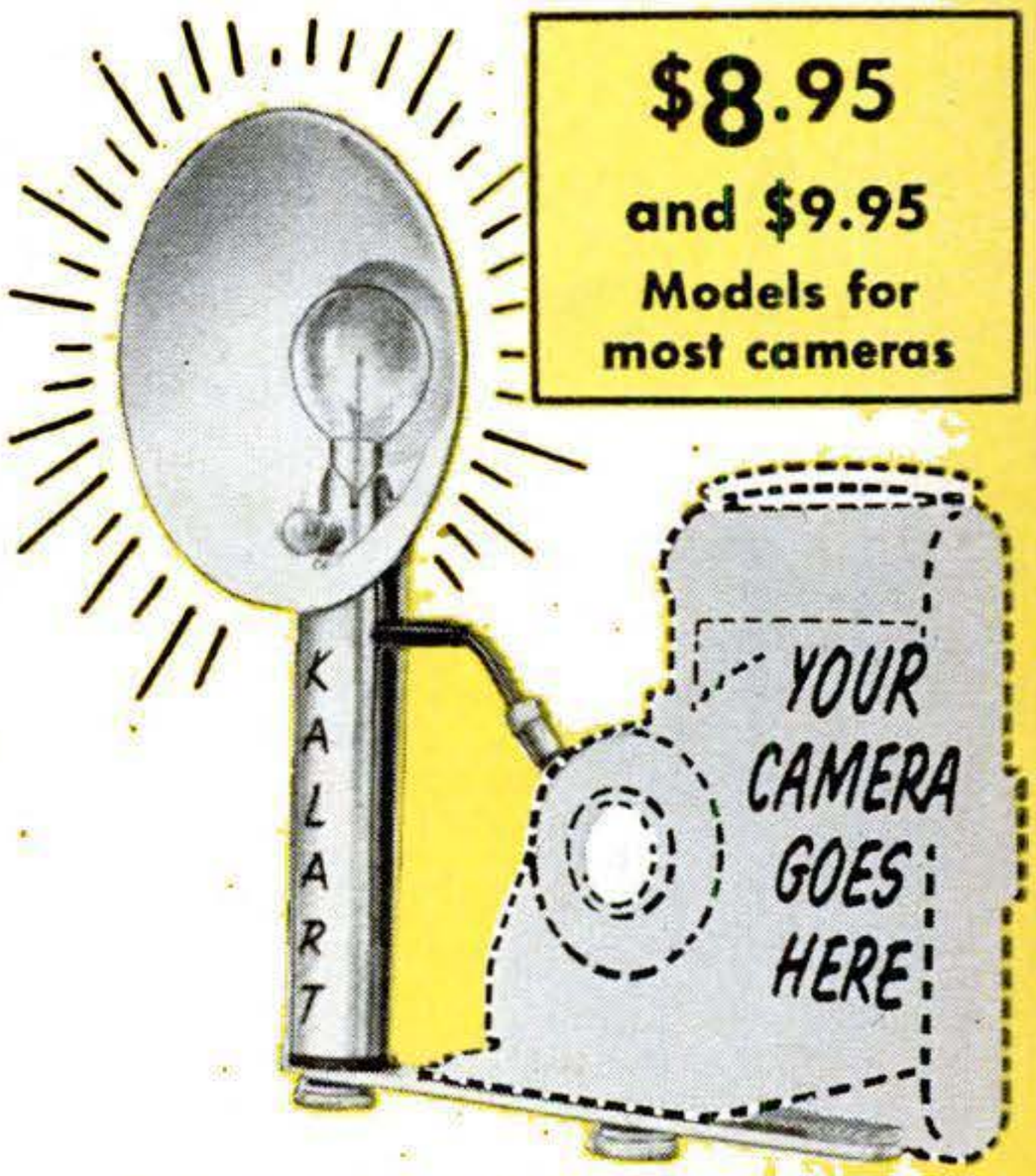

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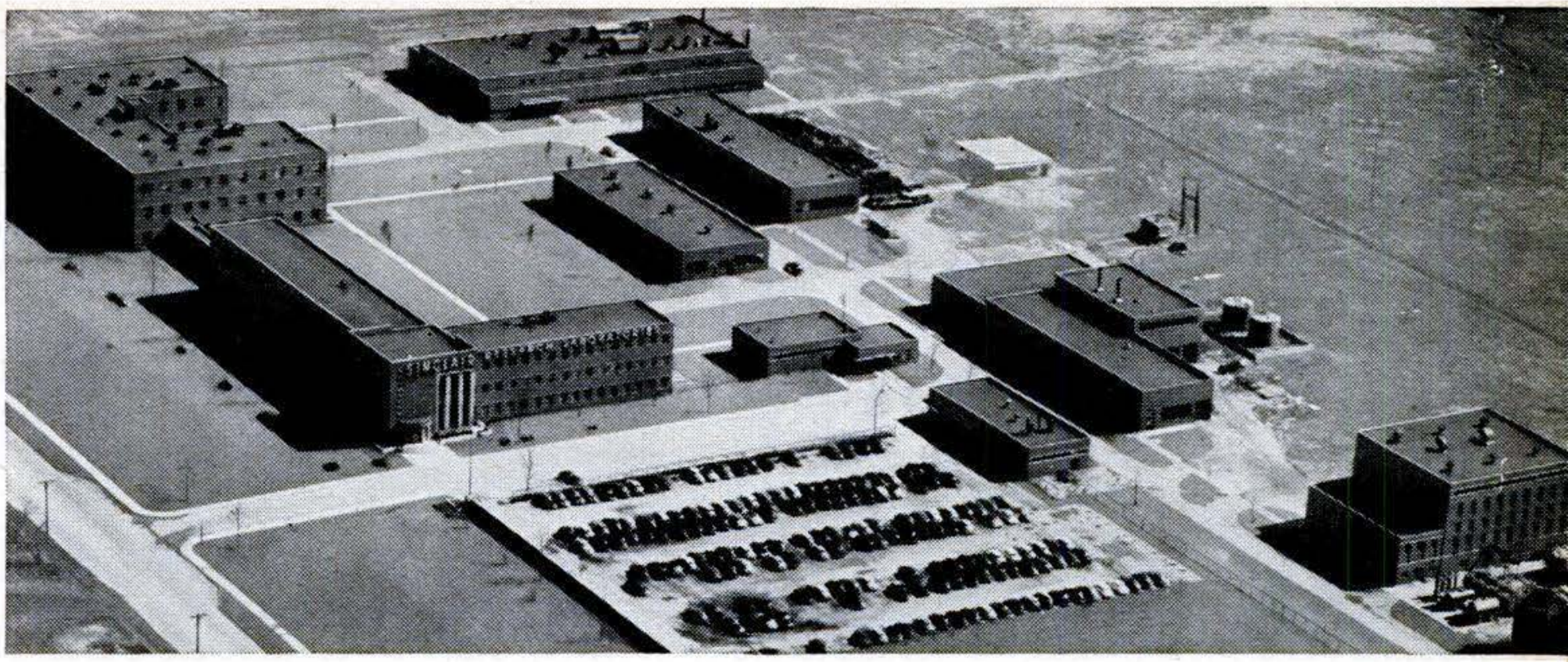

SINCLAIR RESEARCH LABORATORIES—nine buildings containing the most modern testing equipment known—have contributed many of today's most important developments in petroleum products, production and refining. Under the Sinclair Plan, the available capacity of these great laboratories is being turned over to work on the promising ideas of independent inventors who have no such facilities within their reach.

An Offer of Research Facilities To Inventive Americans Who Need Them

The Sinclair Plan is opening up the Company's great laboratories to every American who has an idea for a better petroleum product

INVENTIVE Americans are often at a loss today. Not because of any lack of ideas, but because of a need for large and expensive facilities to find out if and how their ideas work.

This was no obstacle in our earlier days. The Wright Brothers designed their first airplane with the help of a foot-square homemade "wind box"—and the plane flew.

In contrast, the man with a new idea in airplane design today often needs a supersonic wind tunnel costing millions.

In short, science and invention have become so complex that a man with an idea for a better product often needs the assistance of an army of specialists and millions worth of equipment to prove his idea has value.

Within the petroleum field, the Sinclair Plan now offers to provide that assistance.

Under this Plan, Sinclair is opening up its great research laboratories at Harvey, Illinois, to independent inventors who have sufficiently good ideas for better petroleum products or for new applications of petroleum products.

If you have an idea of this kind, you are invited to submit it to the Sinclair Research Laboratories, with the provision that each idea must first be protected, in your own interest, by a patent application, or a patent.

The inventor's idea remains his own property

If the directors of the laboratories select your idea for development, they will make, in most cases, a very simple arrangement with you: In return for the laboratories' investment of time, facilities, money and personnel Sinclair will receive the privilege of using the idea fo its own companies, free from royalties. This in no wa hinders the inventor from selling his idea to any of th hundreds of other oil companies for whatever he can ge Under the Plan, Sinclair has *no control* over the inventor' sale of his idea to others, and has *no participation* in an of the inventor's profits through such dealings. More over, it is a competitive characteristic of the oil busines that the new products adopted by one company ar almost invariably adopted by the whole industry. Thi means that the very fact of his agreement with Sinclai should open up to the inventor commercial oppor tunities which might otherwise be hard to find.

How to proceed: Instructions on how to subm ideas under the Sinclair Plan are contained in an Inven tor's Booklet available on request. Write to: W. M Flowers, Executive Vice-President, Sinclair Researc Laboratories, Inc., 600 Fifth Avenue, New York 2 N. Y. for your copy.

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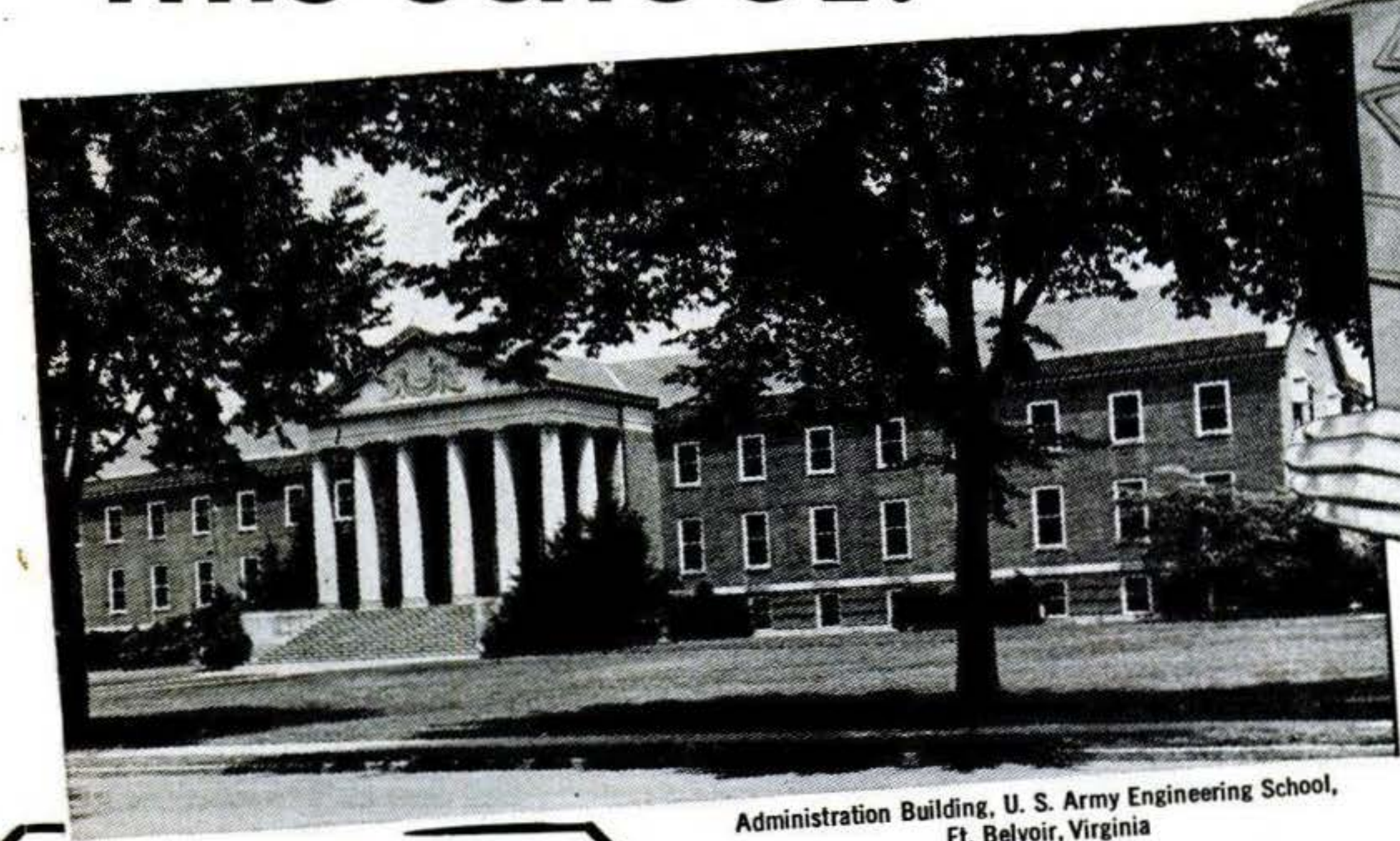

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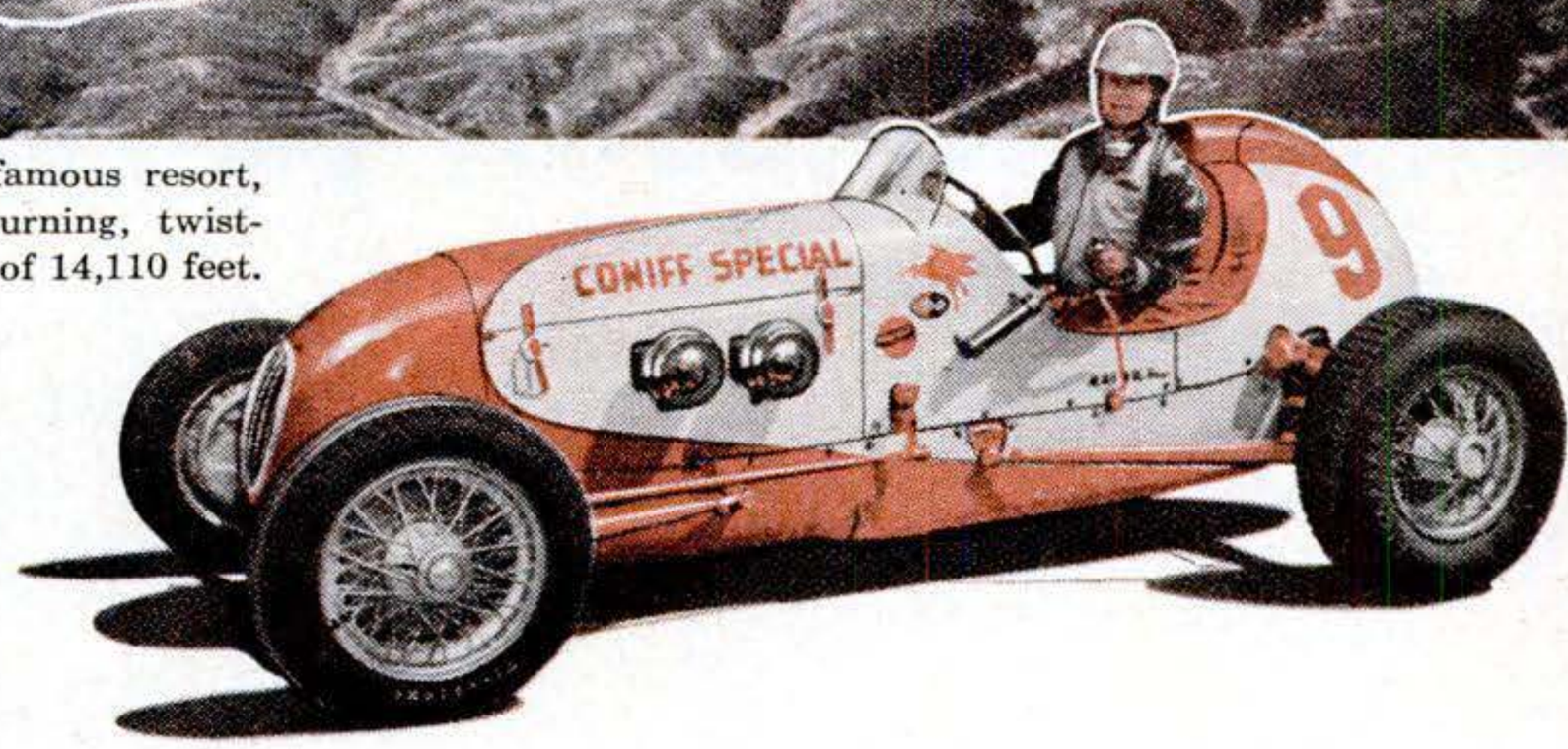
Pikes Peak, Colorado, near the famous resort, Colorado Springs, showing the turning, twisting course which rises to a height of 14,110 feet.



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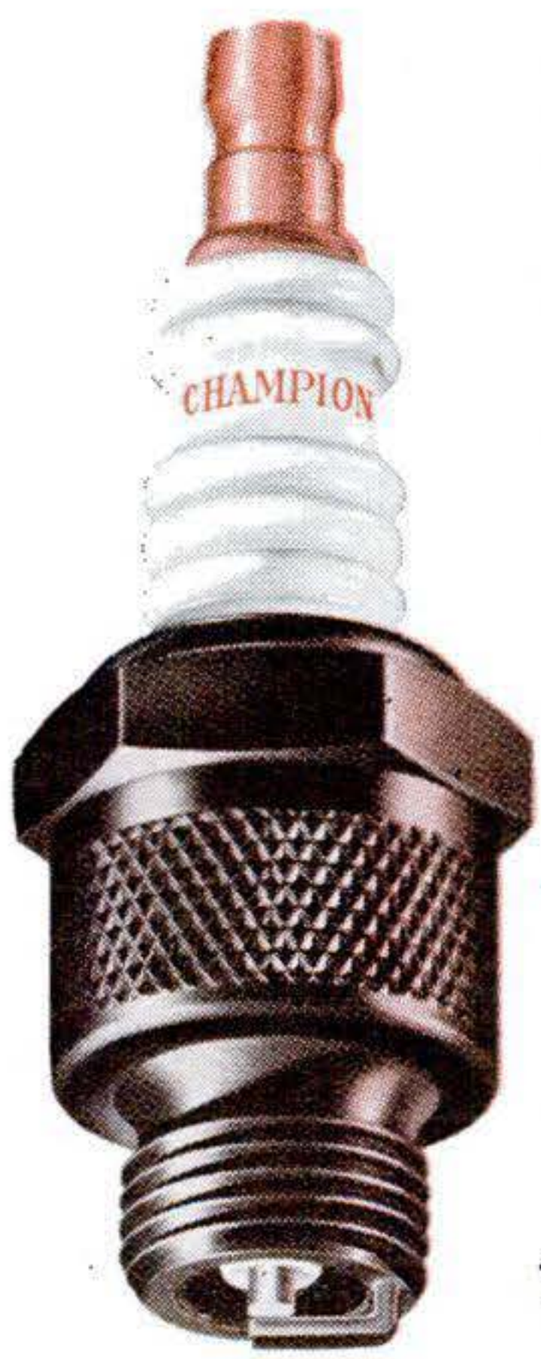

The Pikes Peak Hill Climb is the world's toughest uphill race. Starting at an altitude of 7415 feet, it runs 12½ miles over 120 hairpin turns and switchbacks, ending at an elevation of 14,110 feet!

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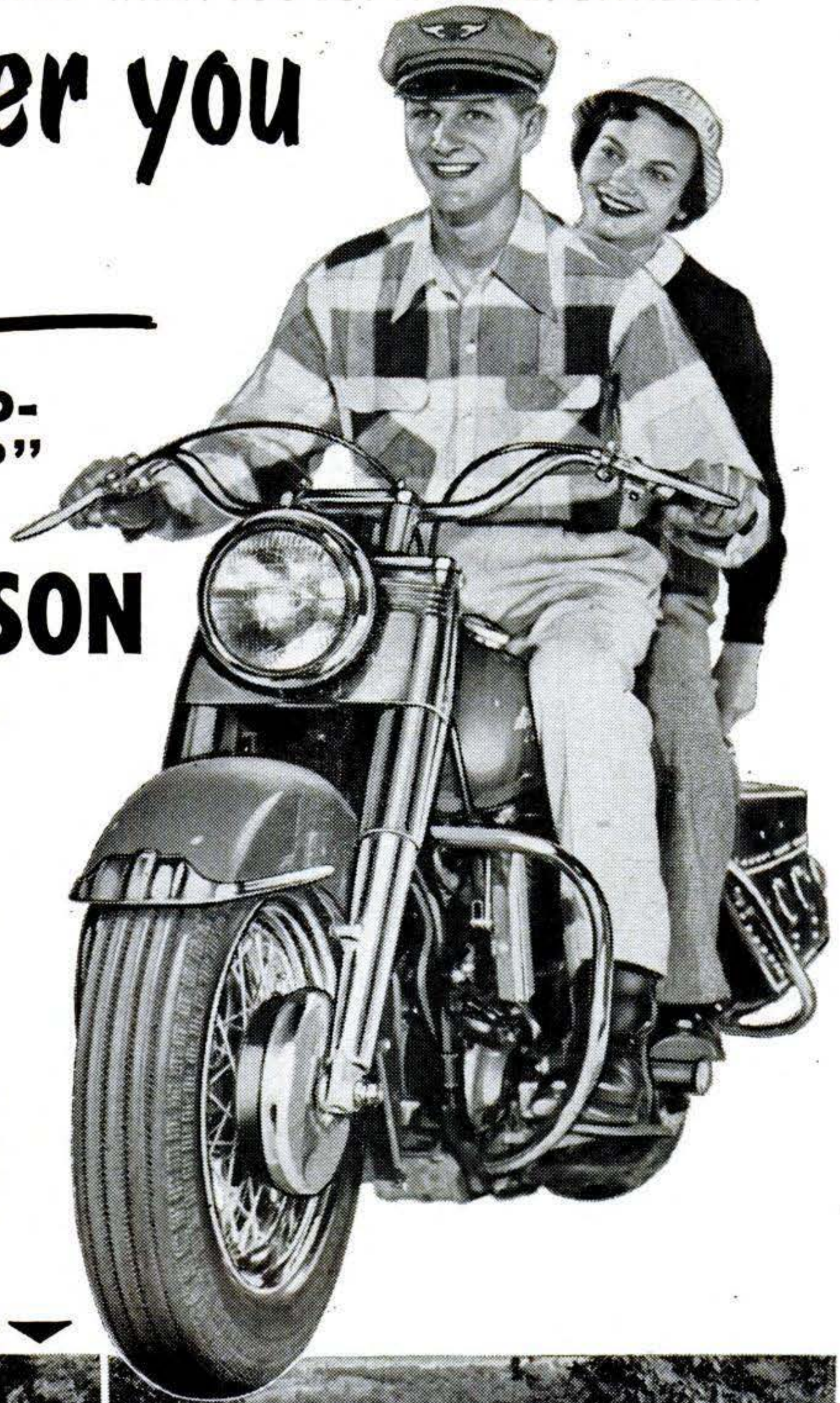

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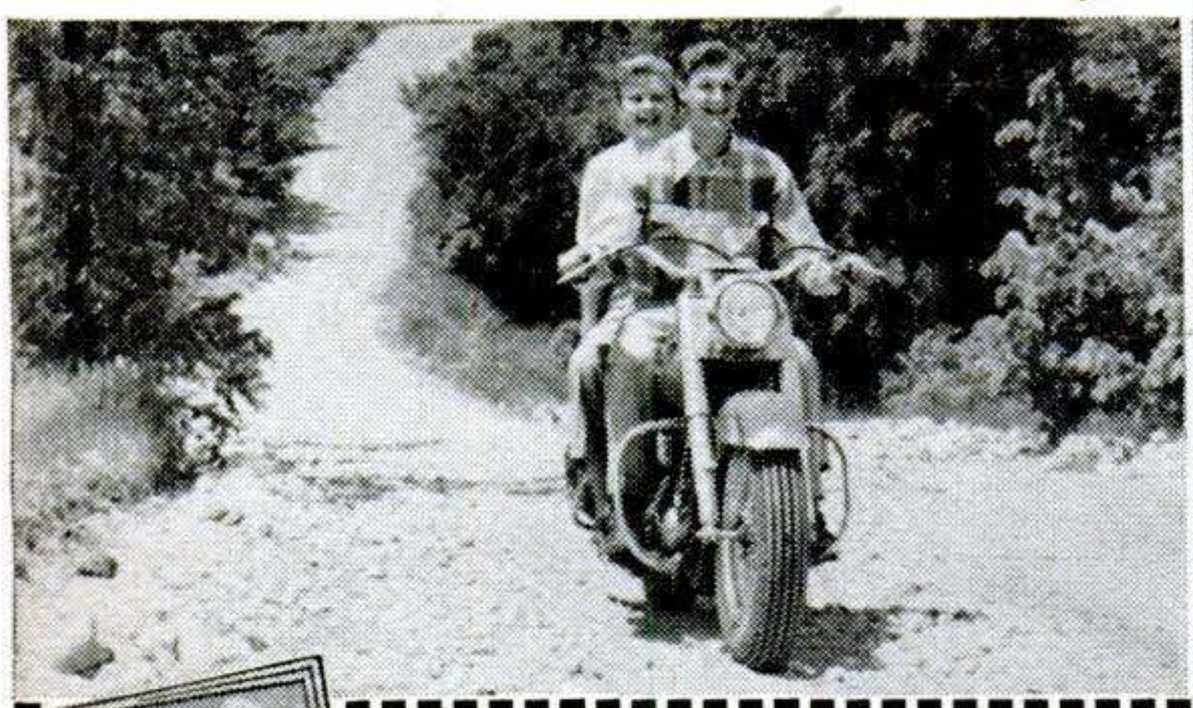

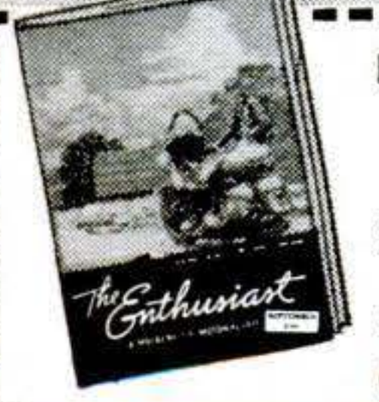

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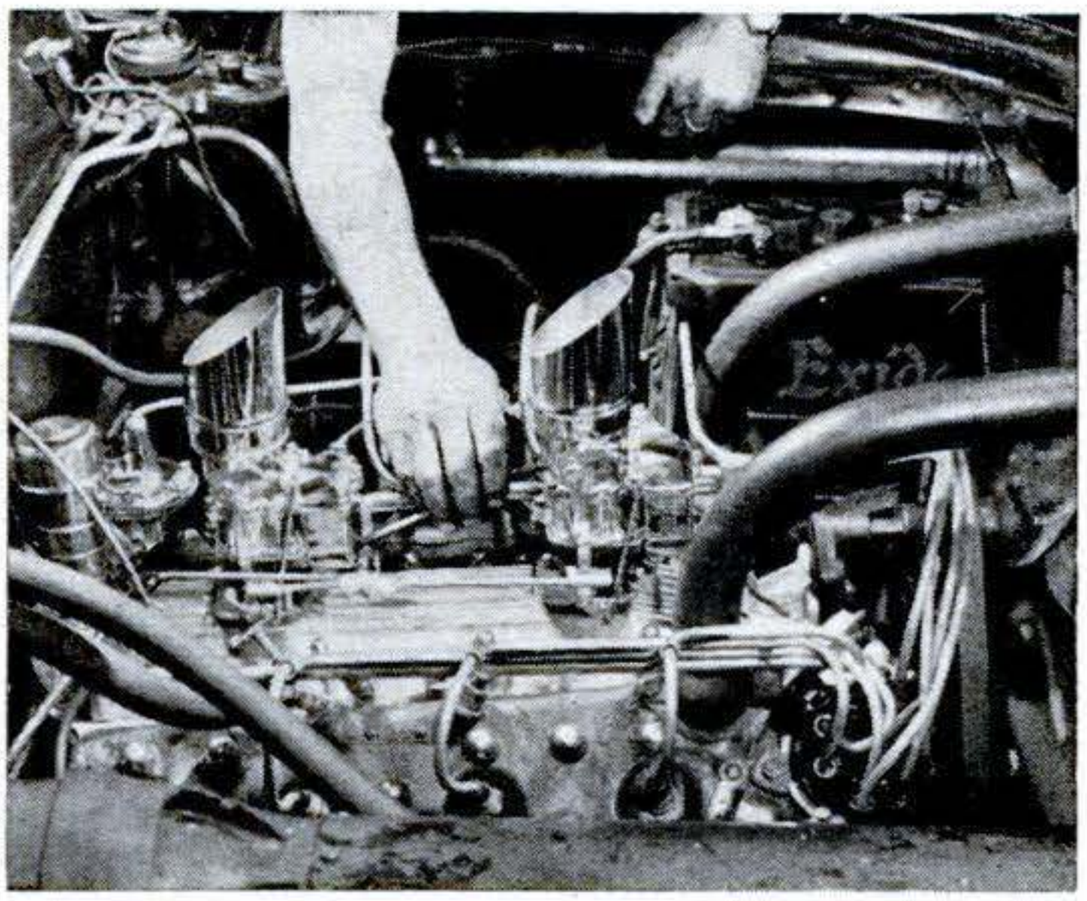
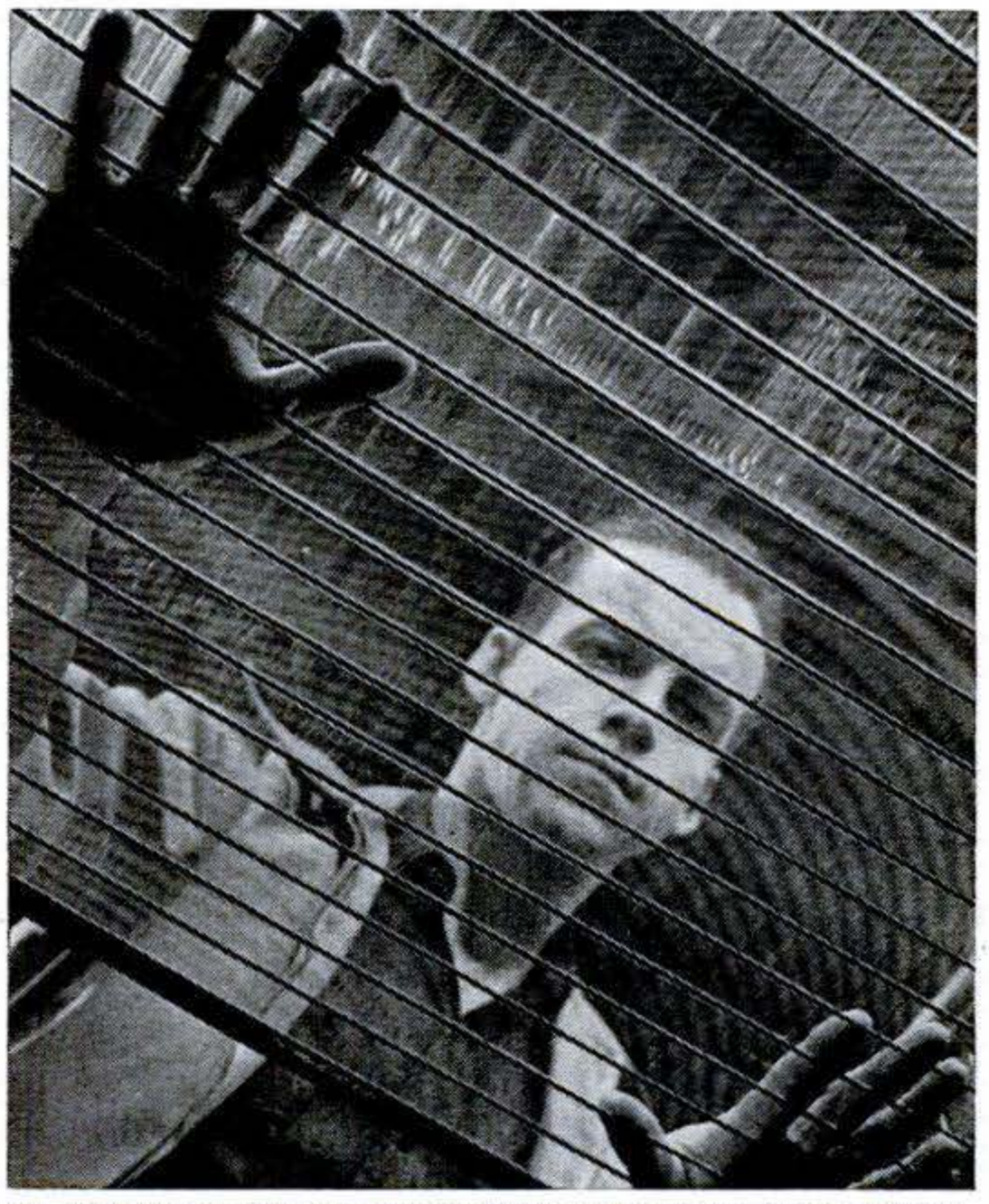
Popular Science *Highlights* This Month



Crazy over horses! From Bangor to Berkeley "hot car" addicts are busy souping up stock engines to squeeze out more horses than the maker put in. Knowledge is power for the guy who knows his high-compression heads and dual manifolds. Here's the lowdown on souping up. Page 189

World's speediest scooter, the Lambretta, is being tested here by a husky New York cop who outweighs the little vehicle he is straddling by almost 100 pounds. A streamlined version of the one-lung, 4.3-hp. two-wheeler topped 125 m.p.h. in Germany last summer. Page 164



Nature's most abundant metallic element is aluminum, yet demand far exceeds supply. Production goal is a staggering 1,600,000 tons yearly of the shiny lightweight metal for fabricating everything from heat-resistant window screens (above) to planes for our Air Force. Page 124

Next to babies and pretty girls what is more photogenic than a cat? Lordly Siamese or lowliest alley specimen, they make wonderful pictures—but it's no job for a fidgety photographer. Read how a noted creator of feline photos persuades Tabby to pose for a portrait. Page 206

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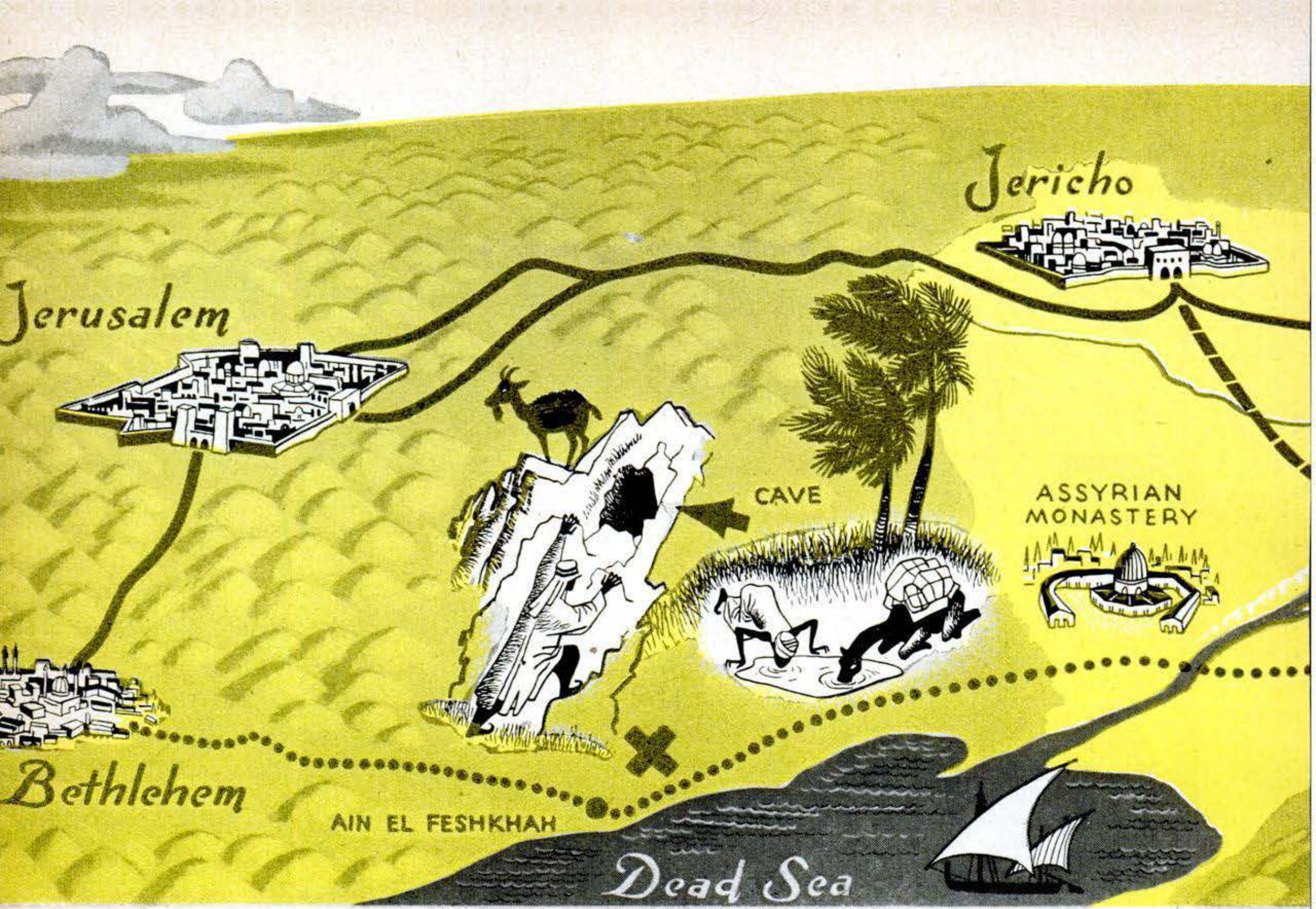
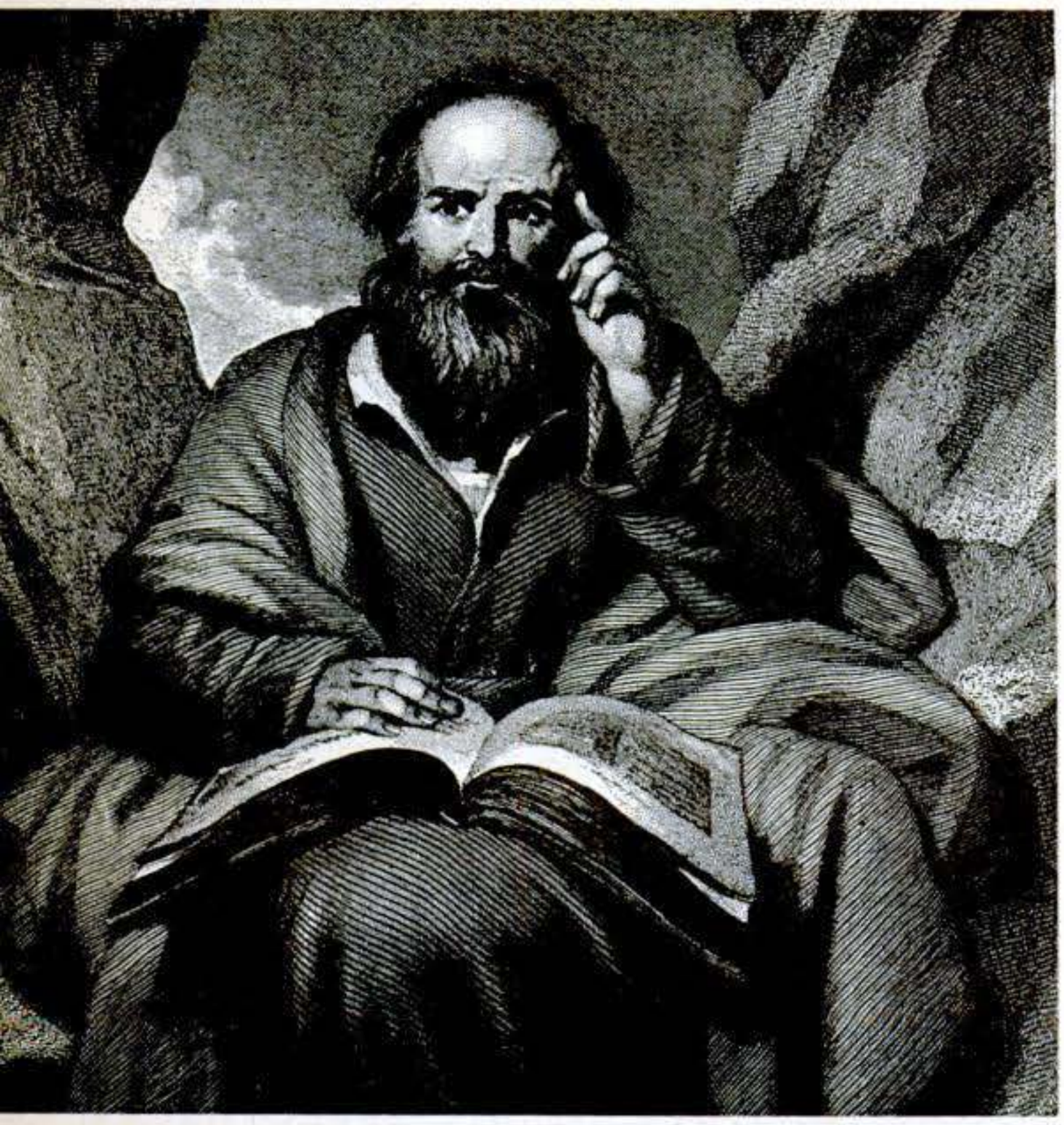


Map shows where Bedouin smugglers discovered copy of Book of Isaiah in cave near Dead Sea.

Atomic Clock Verifies



The Prophet Isaiah pictured in an old print.

By James T. Howard

They shall beat their swords into plowshares, and their spears into pruning-hooks; nation shall not lift up sword against nation, neither shall they learn war any more.
—ISAIAH II, 4.

WHEN the atom bomb first mushroomed its message of death and destruction into the sky six years ago, there were many who speculated on the future uses of atomic knowledge. But few if any put Bible study on their list.

Now, as Christmas of 1951 nears, we find the seeming miracle has come to pass. Science is revealed as the handmaid of religion; radioactive carbon-14 and the Geiger counter are instruments for casting new light on the accuracy of our modern Bible. Cosmic rays that bombarded the earth when Christ was born have left behind a coded

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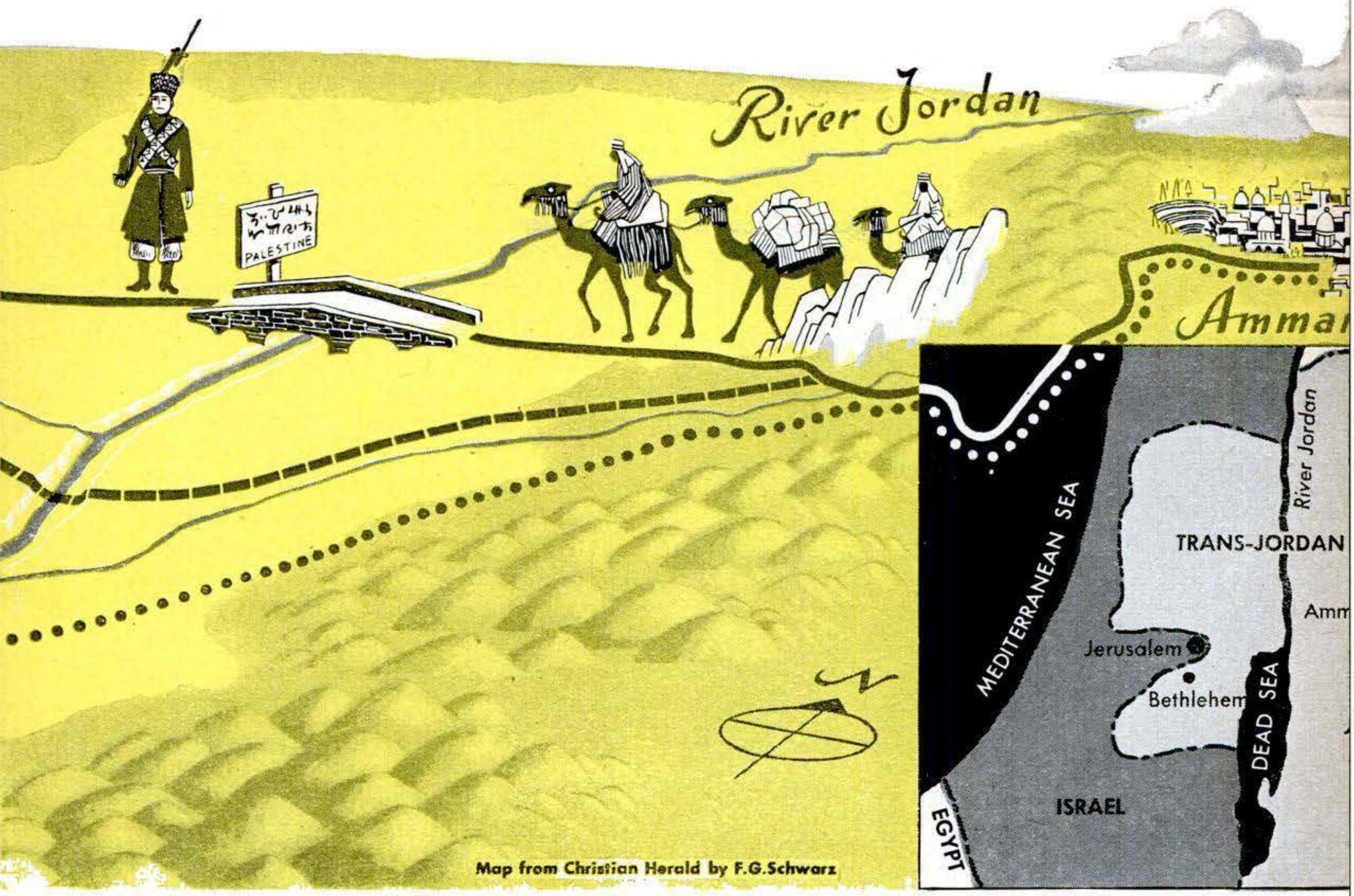

Modern wise men with Geiger counters have proved the scrolls were buried at time of Christ.

Oldest Bible Manuscript

message for nuclear physicists to decipher.

It was strangely fitting that nuclear scientists, turning from war to peacetime research, should undertake the task of determining the age of an ancient transcript of the Book of Isaiah, usually considered the greatest of the Old Testament prophets.

For it was Isaiah who, 25 centuries ago, envisioned a time when the weapons of war would be reconverted forever into the tools of peace. And it was Isaiah who asked: "Who hath measured the waters in the hollow of his hand, and meted out heaven with the span, and comprehended the dust of the earth in a measure, and weighed the mountains in scales, and the hills in a balance?"*

Science hasn't yet achieved all the answers to that all-embracing query; but it has established, with its strange modern tools, that an ancient Hebrew scroll of the Book of Isaiah is the oldest known Biblical manuscript in the world, dating back approximately to the time Christ walked the earth.

This Isaiah is one of the famous "Dead Sea scrolls" which made headlines back in 1947 when they were found in Palestine. A band of Bedouin smugglers, traveling a back-country route to Bethlehem to avoid arrest, camped one night at the oasis of Ain el Feshkhah on the hot north shore of the Dead Sea. There a goat escaped and led the Bedouins a merry chase over the rocky desert terrain. One of the pursuers lost interest in the chase when he suddenly came upon a small opening in the face of the rock about four feet above the ground.

Presently it was discovered that he had stumbled on the mouth of a small cave, an opening through which a thin man could crawl, proceeding to an antechamber jammed full of earthen jars, many of them sealed with earthen covers.

Like greedy treasure hunters the world over, the illiterate Bedouins quickly smashed

*ISAIAH XL, 12.

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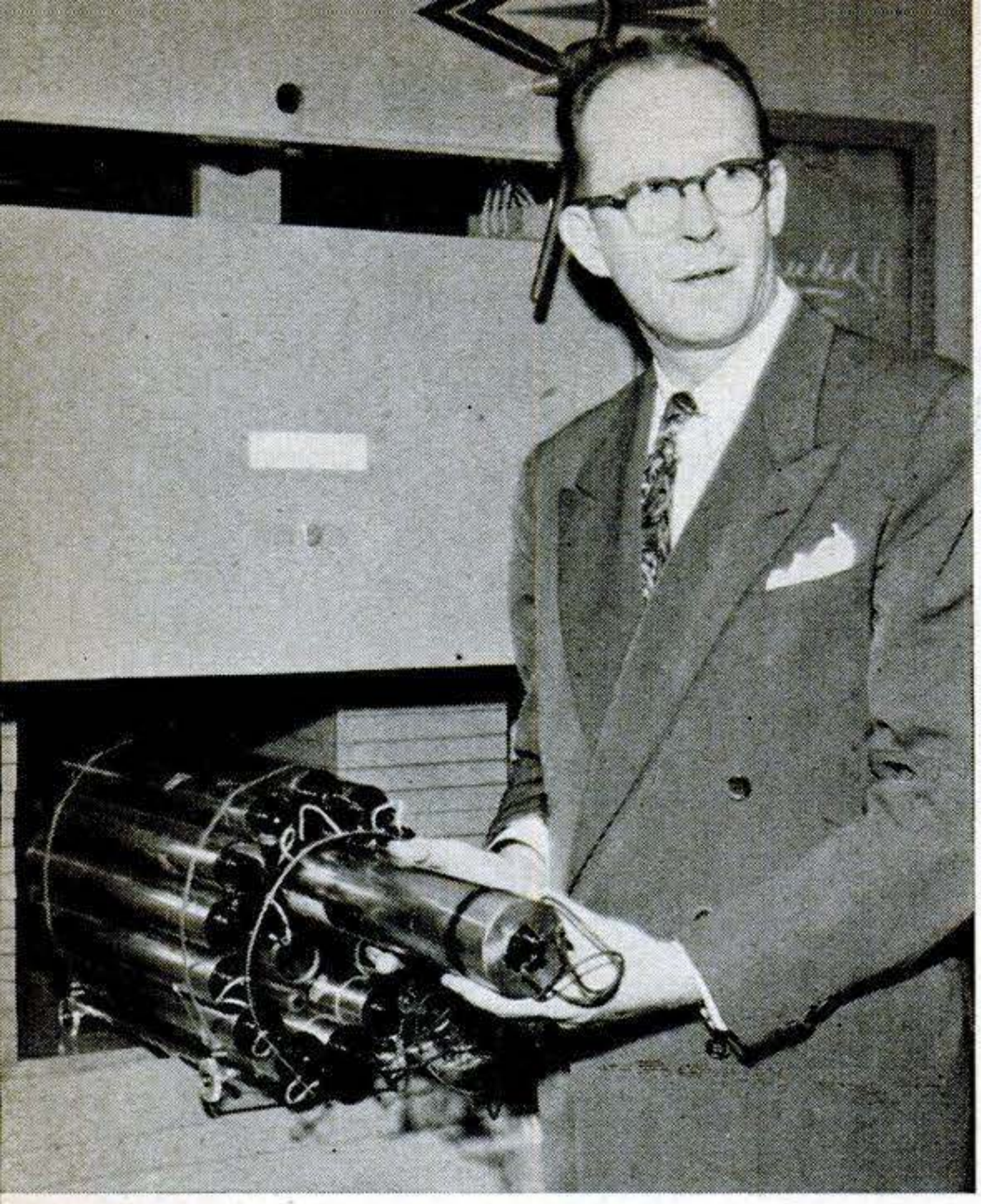

ATOMIC CLOCK: Professor Libby inserts sample of carbon-14 into a battery of Geiger tubes. They will determine age of once-living matter from which it came by measuring its radioactivity. Steel shielding helps keep out interference from cosmic rays.

jar after jar, cursing their luck because the treasure that tumbled out was neither gold nor precious stones. To their minds, the rolled parchments were so much brittle rubbish to be crushed underfoot and kicked aside.

Fortunately, among the smugglers were one or two who sensed a chance for making at least a small profit from the disappointing windfall. They salvaged an armful of scrolls, ones that appeared to be in better condition, and undertook to peddle them as curious antiquities in the black market of Jerusalem.

Isaiah in Bargain Buy

Buyers included Jewish and Arabian scholars and collectors, but the best bargain went to the Assyrian Archbishop of Jerusalem, Yeshue Samuel. For a handful of coins he acquired a package lot of five scrolls. One of these proved to be the priceless Isaiah, a complete script closely written over almost 24 feet of parchment, all in a remarkable state of preservation.

Samuel didn't realize the full extent of the bargain he had bought until experts from the American School of Oriental Research visited his monastery and assured him that these were the most important Biblical documents unearthed in perhaps a thousand years. In due time, the Archbishop journeyed to America with his five precious scrolls, depositing them temporarily in the Oriental Institute at Chicago for translation and study.

Experts Disagree on Age

Meanwhile, there developed a bitter conflict over the age and authenticity of the scrolls. The archeologists, with few exceptions, agreed that the scrolls dated from the first or second centuries. They reached this conclusion by traditional methods of dating: by comparing the texture of jars and parchment and wrappings with other products of the early Christian era. Arrayed against them was another band of experts, including scholars, who maintained that the literary style of the Isaiah definitely marked it as a product of the Middle Ages, the period from 600 to 900 A.D.

So the dispute stood, seething and uncertain, when an unidentified peacemaker with a realistic, modern mind proposed a solution. The Dead Sea scrolls were in Chicago. Virtually around the corner was the University of Chicago, where nuclear physicists had established a technique for measuring the age of plant and animal matter. What could be simpler than to have the physicists settle the dispute once and for all?

"Atomic Calendar" Put on Job

Dating by radioactivity is the brain child of Willard F. Libby, a radiochemist, who, with several associates, had developed the technique known now as the "atomic calendar." Libby discovered that the constant bombardment of cosmic rays from stellar space turns nitrogen in the atmosphere into radioactive carbon-14. Every breathing thing—plant or animal—takes in some of this carbon-14, which is retained even after breathing stops. Because the radioactivity of carbon-14 declines by half in 5,600 years, it is possible to arrive at the approximate age of any plant or animal matter by measuring the radioactivity of its carbon-14.

By this technique, Libby already had estimated the age of wood from an Egyptian mummy's casket, flooring from a Syrian palace, cedar from an Egyptian funeral boat and other items, checking in each instance with dates established by archeologists using traditional methods.

Dating the Isaiah scroll was just another

[Continued on page 278]

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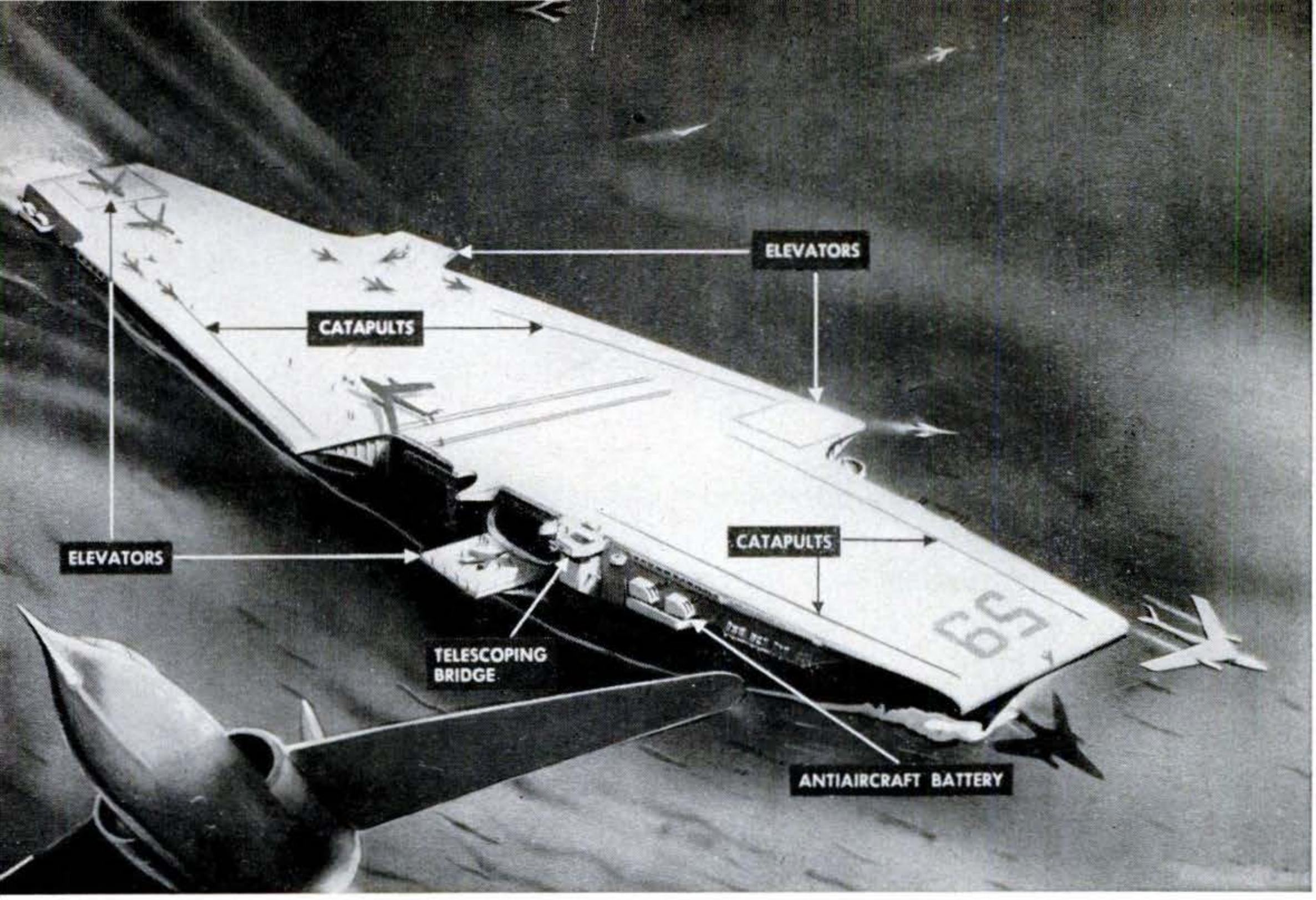


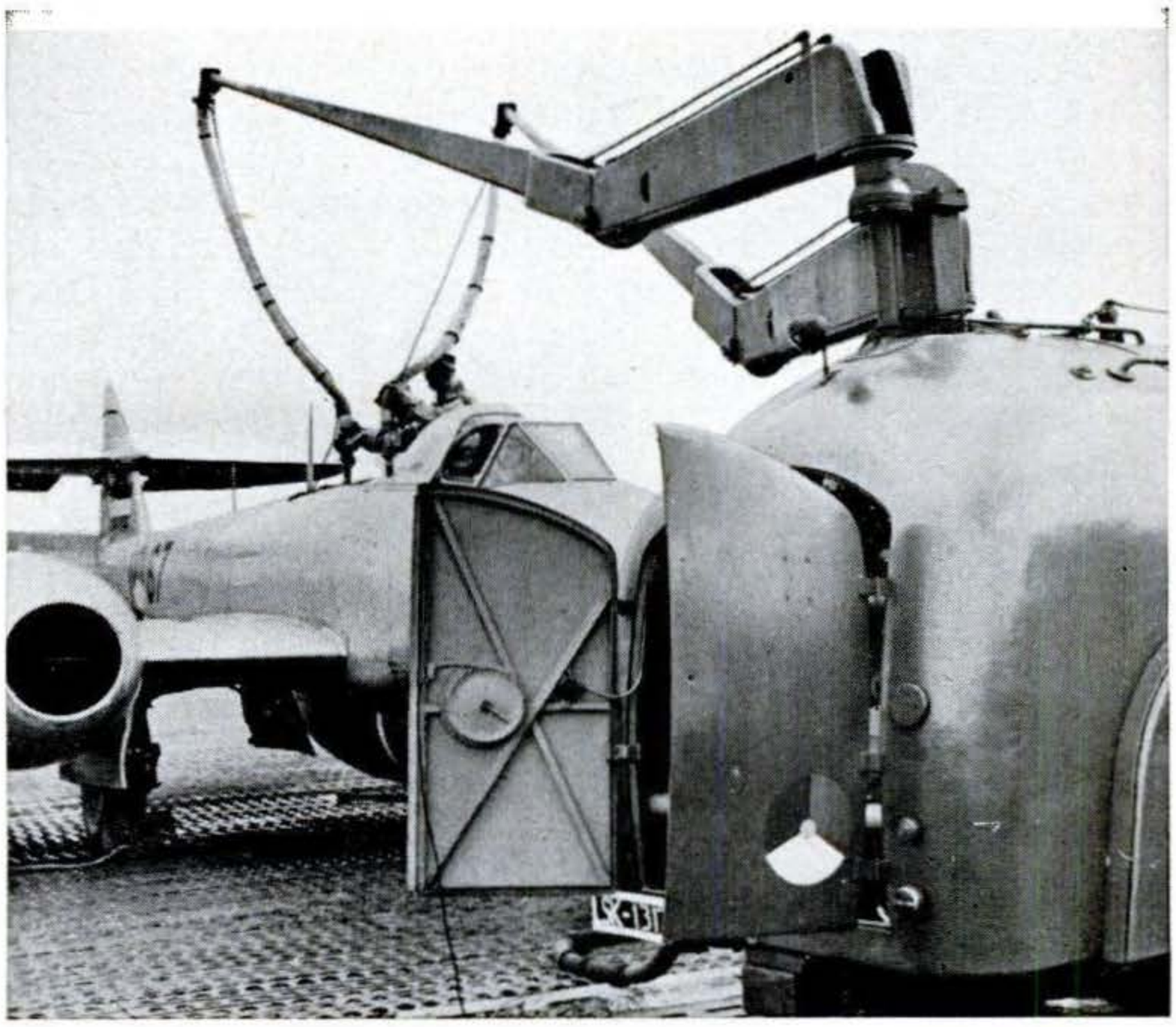
Navy's New Carrier Will Be Flattest Flattop

HERE'S an artist's conception of the Navy's new and biggest aircraft carrier, the USS *Forrestal*. When it is finished three years from now, the 59,900-ton vessel will have a fifth of a mile of completely flat deck to handle the fastest and heaviest jet planes. It will have a retractable bridge that can be lowered to keep it from obstructing aircraft, and a television system to aid in landing the planes. The keel is scheduled to be laid next summer by Newport News Shipbuilding and Drydock Co. in Virginia. The ship will cost $218 million and carry 3,500 men.

Twin Booms Refuel Plane

IT TAKES only two and a half minutes for the twin hose-carrying booms on this fuel truck to fill the two fuselage tanks of a jet fighter. The giant trailer-truck tanker can carry 2,650 gallons and travel at a top speed of 38 miles an hour.

Designed and built in the Netherlands, the all-welded tanker-trailer was introduced internationally at RAF maneuvers in England this year. It proved to be the fastest of several tankers that were being used during the war games.



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Here comes TV for

The whole country, and not just a few metropolitan centers, will enjoy television when new ultra-high-frequency stations go on the air.

IF YOUR home is outside the TV areas today, it is almost sure to be inside one within a few years. If you now can get only one or two stations, you'll have a wider choice pretty soon.

Right now a total of 108 television stations are on the air. They all use waves from four to 18 feet long in the very-high-frequency range, called VHF. In the VHF range, only a few hundred stations can be fitted without interfering with each other. That's barely enough to whet the American TV appetite. Now television is about to invade a new region of radio waves so short that they act almost like radar. These tiny waves, already explored but unused at present, promise you TV shows no matter where you live.

Already 1,357 stations using 52 channels in this ultra-high-frequency range—UHF—have been tentatively allocated by the Federal Communications Commission. Nearly all are for cities with less than 50,000 population. In addition, many new stations are to be set up in the VHF range already in use for TV. The combination should provide 2,000 TV stations within a few years, predicts FCC Chairman Wayne Coy, extending television's ringside seat on the world to practically every family in the U.S.

What's the Difference?

Shorter waves allow more stations, but they also bring some complications. The pictures won't look any different, and they can be either color or black-and-white. But UHF does not travel so far—about 15 miles against the 40 miles covered by today's VHF. (This is an advantage as well as disadvantage: stations can be closer together without interference.) And since UHF acts somewhat like radar, it is more easily blocked by buildings and even the leaves of trees. On the credit side is a greater immunity to trouble from automobile ignition systems, neon signs and electrical machinery.

Present TV receivers and antennas are made for VHF, not UHF. To pick up the UHF stations, they will have to be changed. Fortunately, the conversion job is simple. The cost is expected to range between $20 and $75.

Experimental Converters Made

Nearly all manufacturers have made experimental attachments that will enable standard television receivers to pick up UHF stations. Most of them work by changing the UHF to a frequency now used for one of the VHF channels. The standard set then handles this reduced frequency just as if it were tuned to that VHF channel.

Crosley, General Electric and RCA, among others, have demonstrated converter attachments that look like table-model radios. They are wired to the inside of the standard set. To operate one, you simply flip a switch and turn the converter dial to the UHF channel you want. The converter covers all UHF channels. Probable cost: $30 to $50. With the UHF switch off, the standard set works as it always did for the VHF stations. Eventually, when a sizable number of UHF stations are on the air, such converters will undoubtedly be standard equipment, built inside sets.

Other manufacturers—Zenith and Admiral for example—plan an even simpler method of converting their sets. Their present models use "turret tuners": connected to the station-selector knob is a drum made up of 12 metal strips, each strip containing the electronic parts needed to tune in one of today's 12 VHF channels. While the drum comes equipped with 12 tuning strips, no more than seven are used in any one locality

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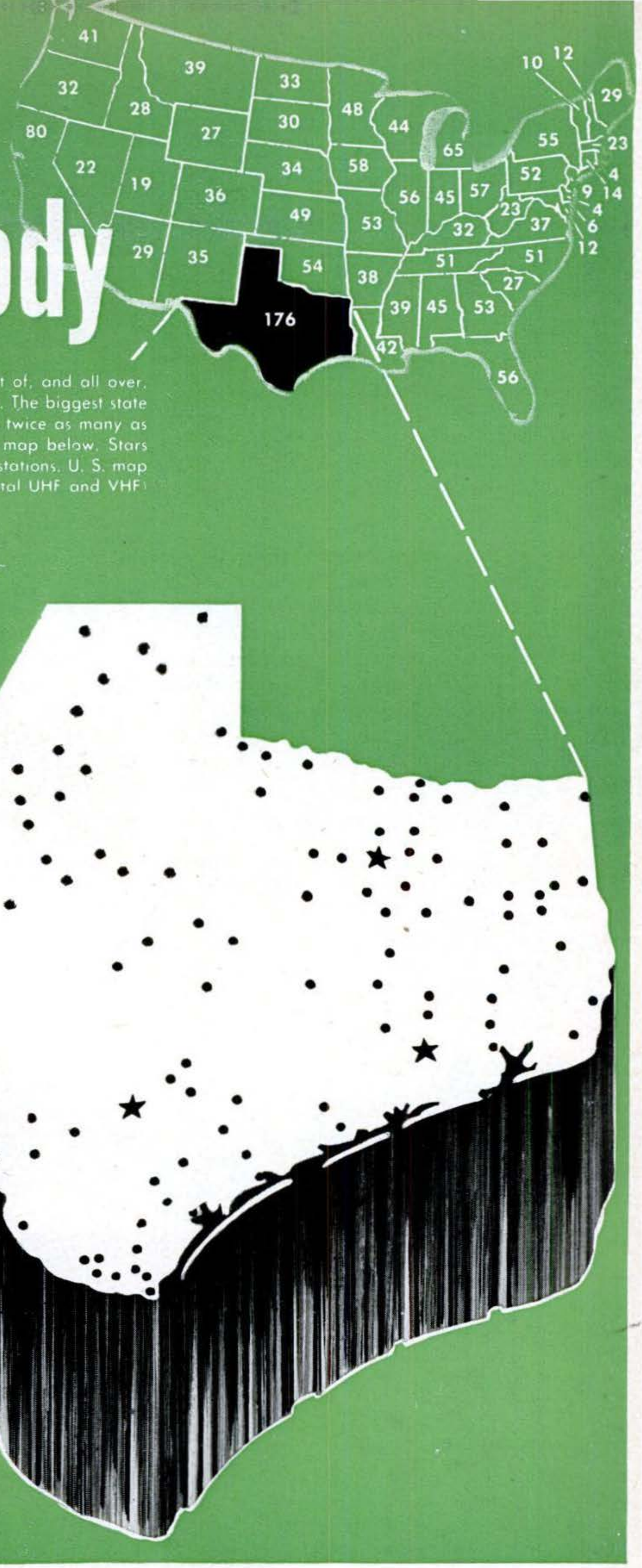
everybody



There'll be television deep in the heart of, and all over, Texas if every proposed station is built. The biggest state is allotted 176 transmitters, more than twice as many as any other state, in places marked on map below. Stars indicate three areas that now have TV stations. U. S. map above indicates how many stations (total UHF and VHF) other states will get.

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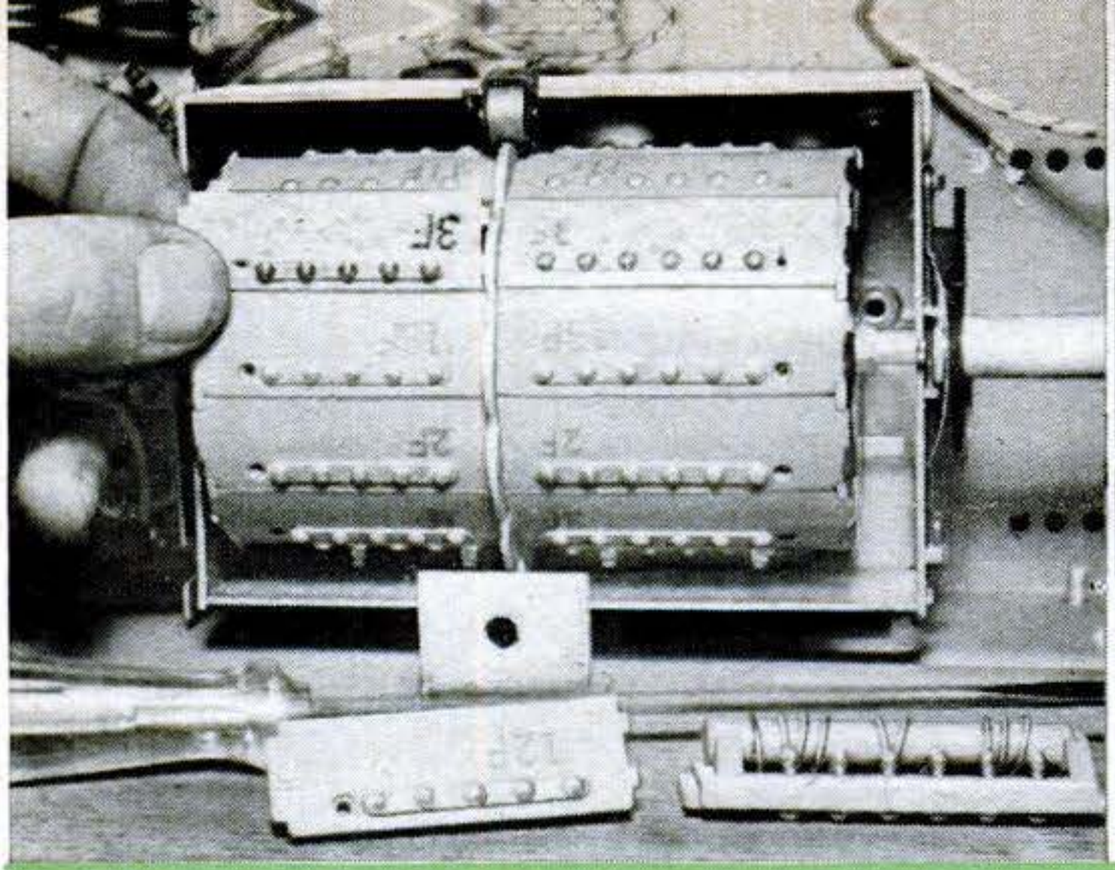
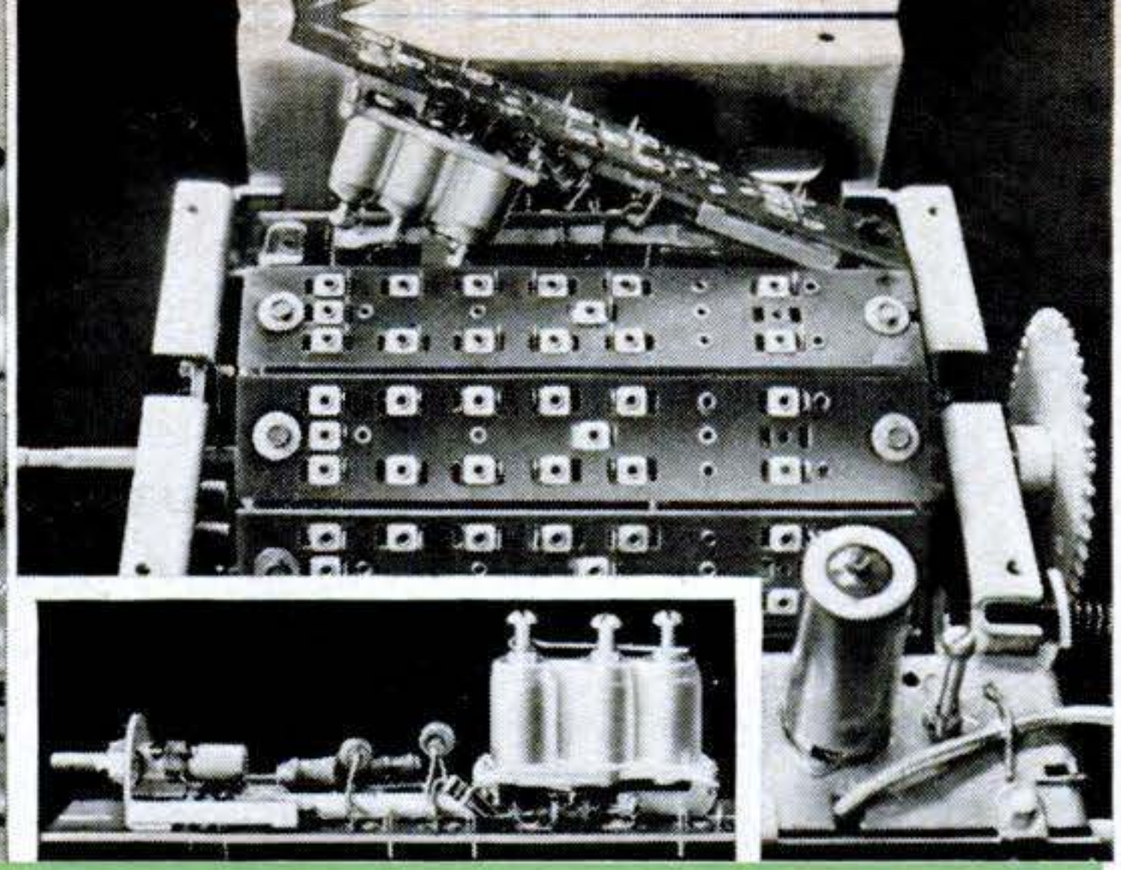


TO GET UHF STATIONS on an Admiral set, you just replace two-inch tuning strips with similar strips made for UHF stations. Many sets can be adapted this way.



UHF CHANGEOVER in current Zenith models is also matter of replacing tuner strips. Inset shows close-up of Zenith strip, which has parts needed to tune in one station.

because no more than seven VHF channels are allocated to one area. That means the unused VHF strips can be replaced with strips that will tune in UHF channels.

The tuning-strip system has the advantage of low cost—a UHF strip should cost about $10. And it is simple—nothing shows outside the regular set, there are no extra switches or dials, and installation is a 10-minute job that requires no tools.

Antenna Change Simpler Yet

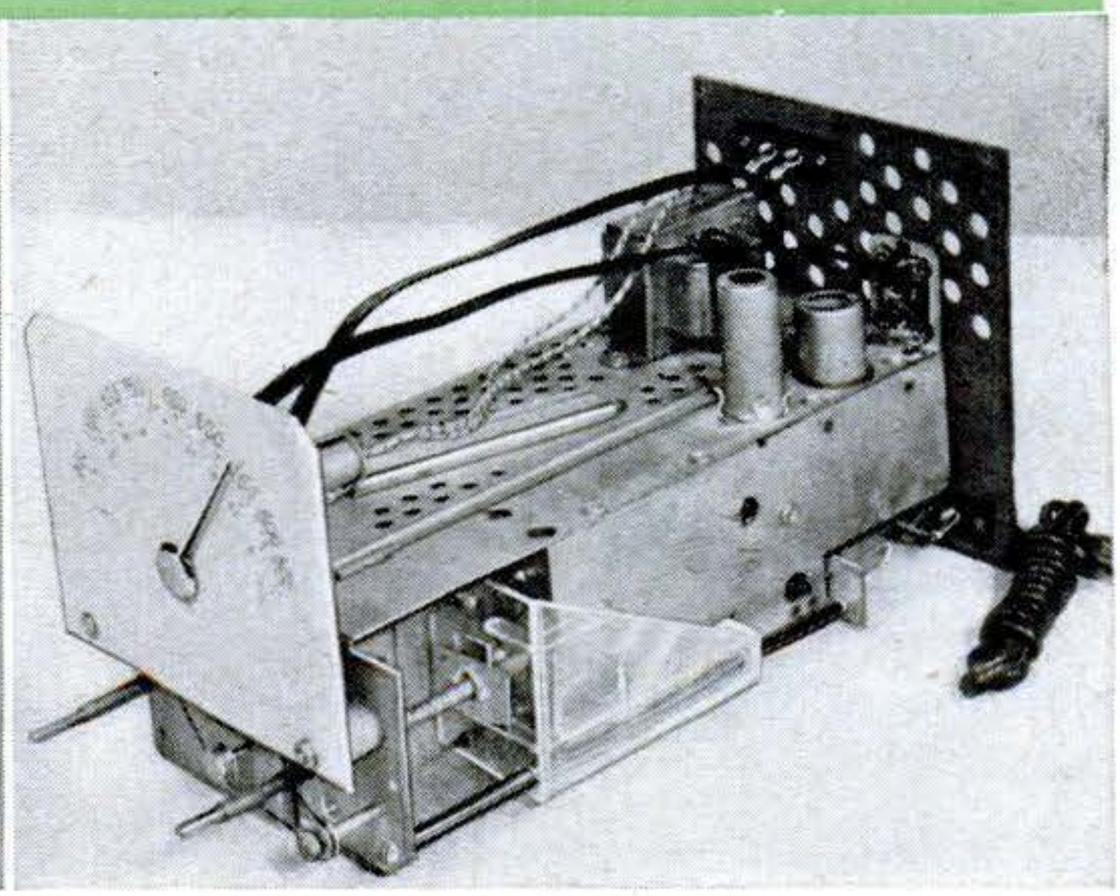
Since UHF waves are so much shorter than VHF, you will need a special antenna to catch them. But it will be small and inexpensive. It would be mounted on top of the mast holding the VHF elements.

Several designs for antennas have already come from experiments with UHF (notably RCA's in Bridgeport, Conn., PS, Aug. '50, p. 111). They range from the tiny and cheap "bow tie," which works best five or six miles from the transmitter, through the efficient "stacked vee" and highly directive, almost ghostproof "rhombic," to the very sensitive "parabolic" and "corner reflector."

Technically, UHF is here. But actually, only a few experimental stations are operating. The FCC's allocations are tentative and will not be made final until public hearings are completed. So it is bound to be a year or so before the first commercial UHF telecasts begin, and several years before you can settle down in your own favorite chair in towns from Ajo, Ariz., to Millinocket, Me.—towns that never had television before—to watch the Rose Bowl game being played thousands of miles away. END

SMALL CABINET on top of standard TV receiver houses GE's "translator" for UHF. A continuous tuner covering all proposed channels, it reduces UHF to VHF.

WORKS OF UHF TRANSLATOR include three tubes, two rectifiers, a crystal detector. Similar devices are planned by manufacturers of many other receivers.



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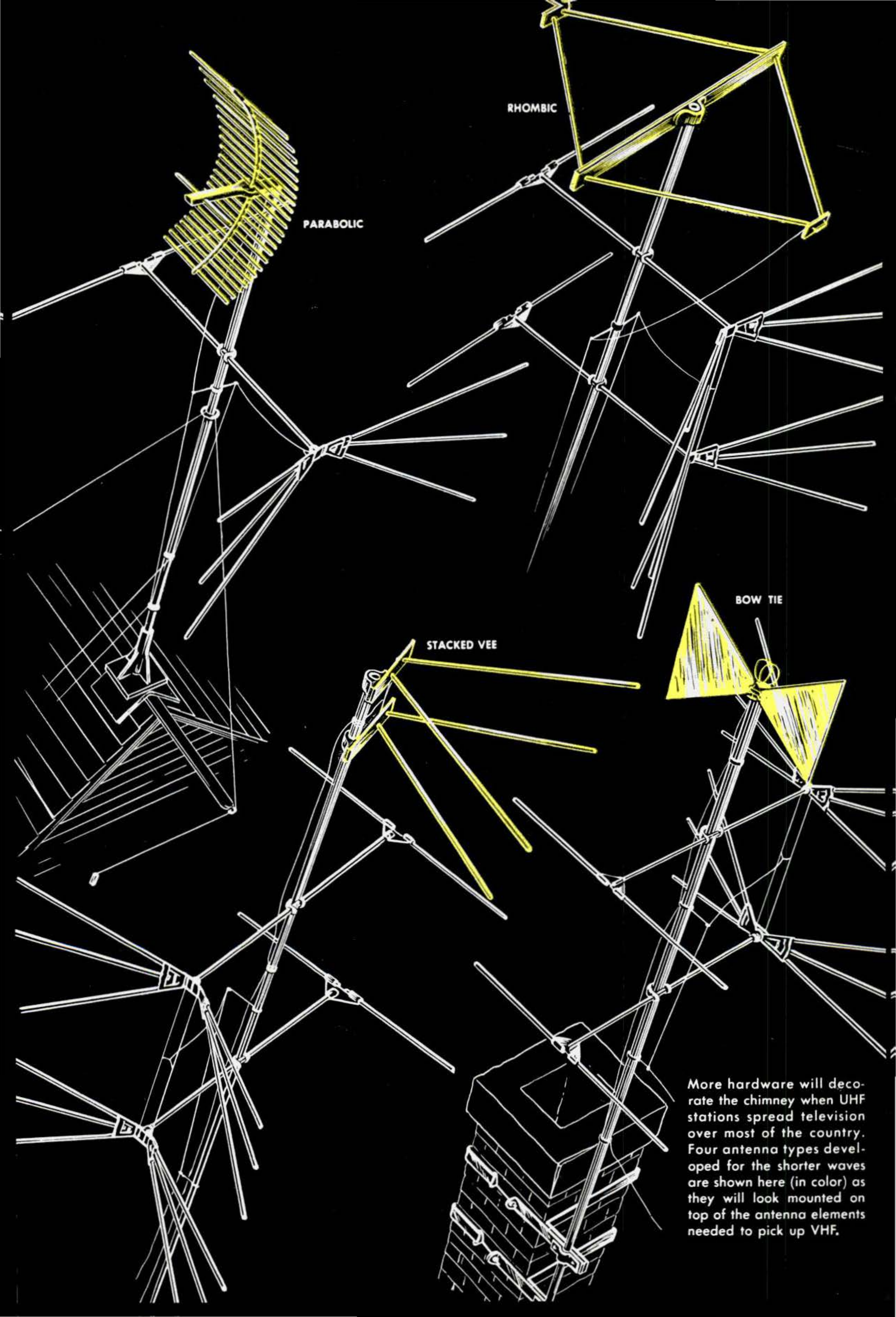
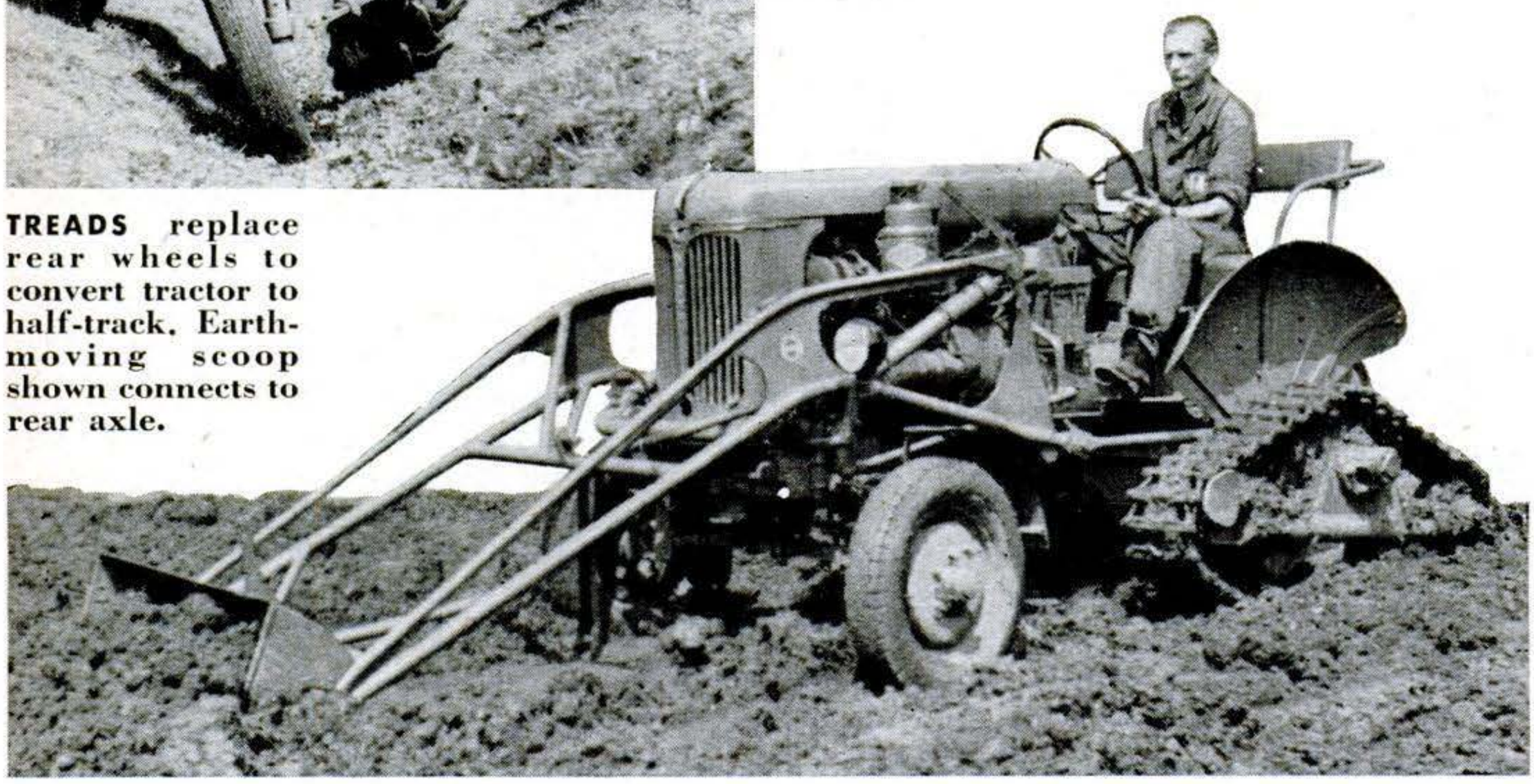


More hardware will decorate the chimney when UHF stations spread television over most of the country. Four antenna types developed for the shorter waves are shown here (in color) as they will look mounted on top of the antenna elements needed to pick up VHF.

Tractor Rides Hilly Ground

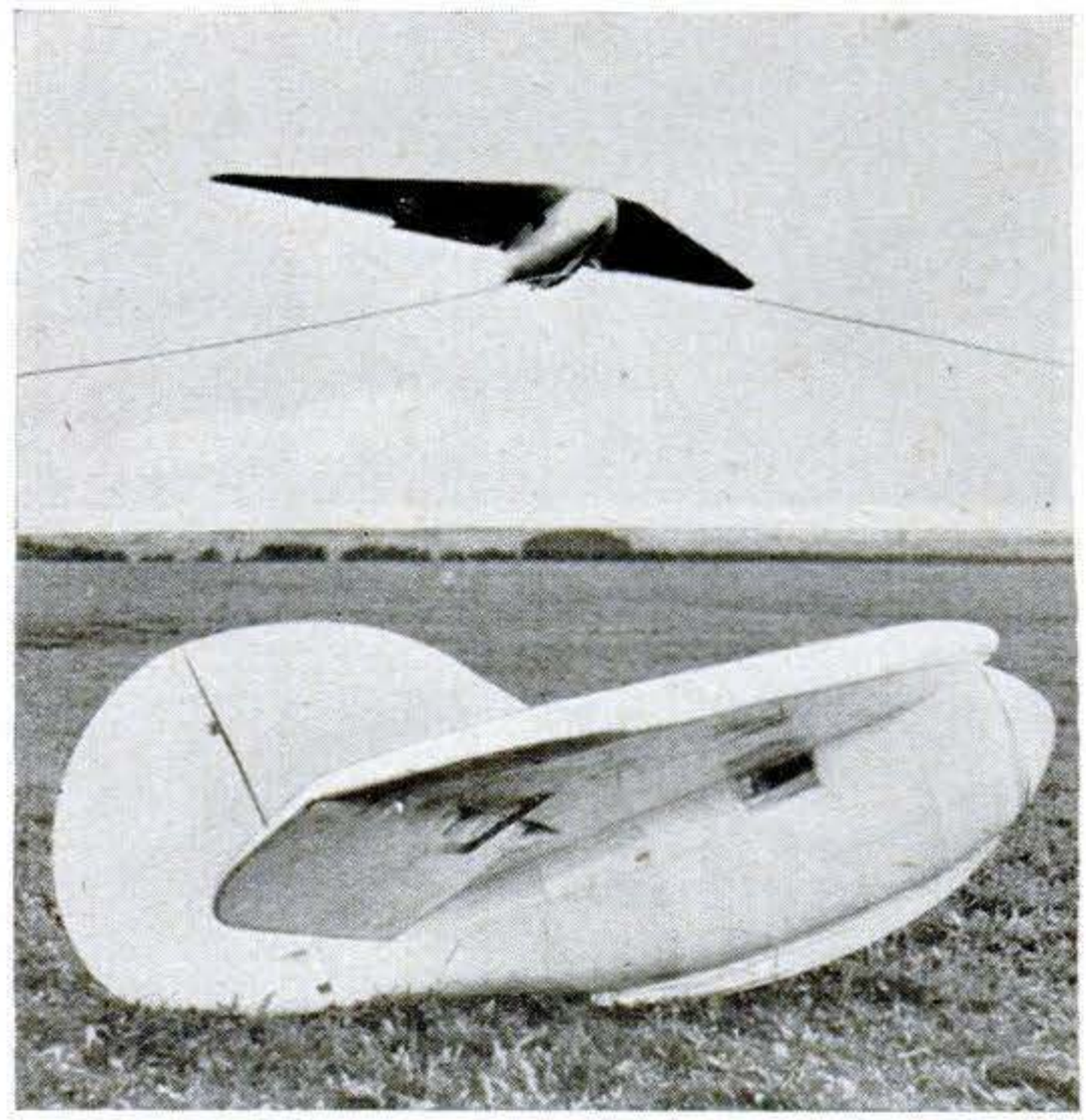
THIS German tractor can cross the roughest terrain without side-slipping or tipping. A pivoted front axle, similar to those on road graders, enables it to straddle gullies or circle steeply graded hills with ease. Diesel-driven, it is made in one- and two-cylinder models. Attachments are available for plowing, harrowing, bulldozing and other farm chores.



TREADS replace rear wheels to convert tractor to half-track. Earth-moving scoop shown connects to rear axle.

Toy Press Prints Type

ANY child who can read can set type on this printing press. The rubber type snaps into slots on the press and is so grooved that it is impossible to set characters upside down. Made in three sizes by the Superior Marking Equipment Co. of Chicago, the press will also print pictures.



German Gliders Fly Again

THIS midget tailless glider, designed by Werner Lutz, German engineer, has a wing-spread of 20 feet and was built for $100. The photos show it about to be released from the tow rope and at rest on the field between flights. Until recently, gliding was prohibited in Germany.

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Toe-Pressure Brakes Stop New Packards

Easy does it with a remarkable system that makes atmospheric pressure handle a third of the driver's braking chores.

By Devon Francis

TO SLOW down or stop in a 1952 Packard you don't even have to take your foot off the floor. Just ease up on the gas by rocking back on your heel, swing your toe a couple of inches to the left, and press down—gently—on a little pedal only slightly higher off the toeboard than the accelerator.

That's power braking.

It has been standard on trucks and buses for years. And now a new type of surge-free, toe-pressure power braking becomes available on passenger cars. The innovation, called Easamatic braking, was announced jointly last month by Packard and the Bendix Aviation Corp.

DOUBLE EXPOSURE of foot on new Packard-Bendix power brake shows how little movement is needed to swivel from accelerator to brake pedal. Heel need not be lifted off floor.

Vacuum Does the Work

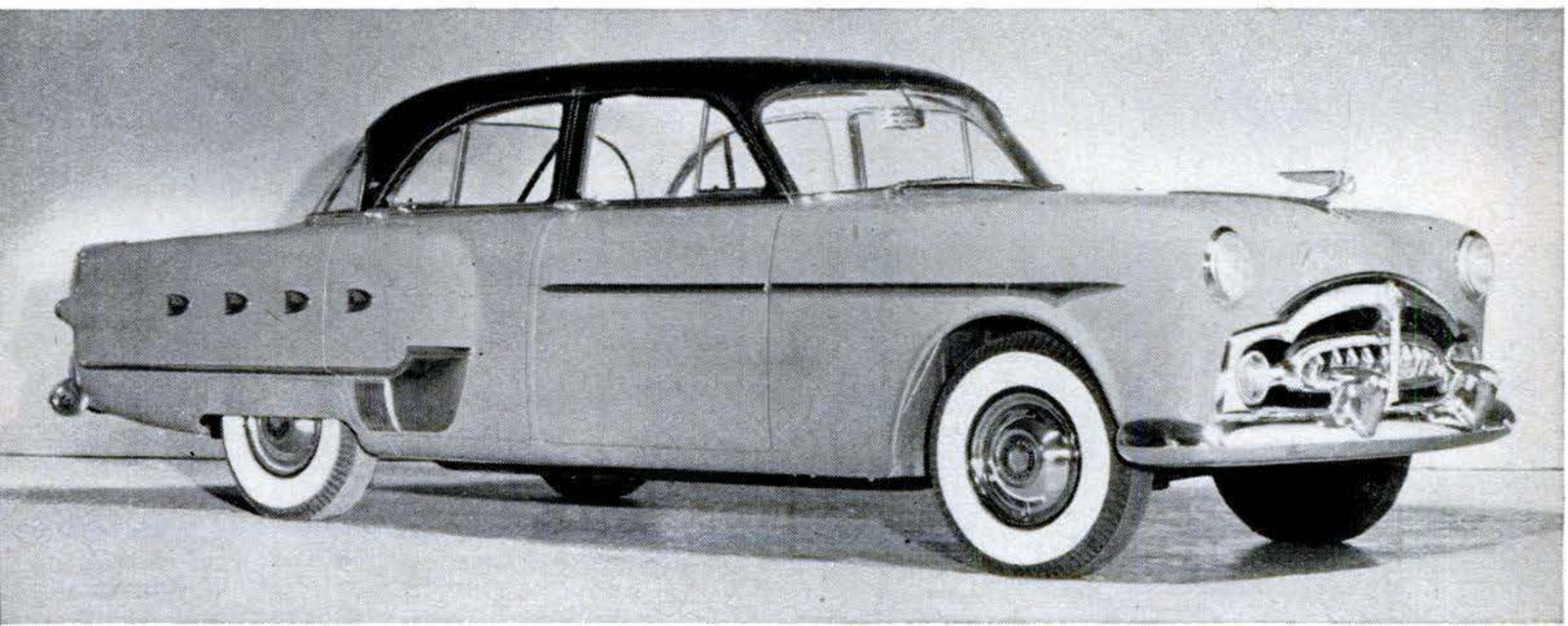
The toe pressure required on the new brake pedal increases gradually—as it should for proper "feel"—with the increasing force of the brake shoes on the wheel drums. But, as a POPULAR SCIENCE reporter discovered when he tried it recently on Packard's test track at Detroit, the push is noticeably less than is required on a conventional brake pedal. Engine vacuum—the same vacuum that runs the windshield wipers—does a third of the work.

Here's how:

A partial vacuum develops in the intake manifold of an engine as the pistons suck in their fuel-air mixture on the intake stroke. This vacuum thus is available—free—as a source of power for light work.

The new brake taps that free power source to make outside air pressure push the conventional master piston which sends hydraulic fluid to the brake cylinders.

As the drawings on the next two pages



Power braking is chief change in '52 Packard. It is standard equipment on Patrician (above).

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show, the vacuum is—in effect—piped into what is little more than a can vented to the outside atmosphere. In the can is a piston. At rest, the piston is "atmosphere-suspended." The air pressure on both sides of it is that of the outside air pressure.

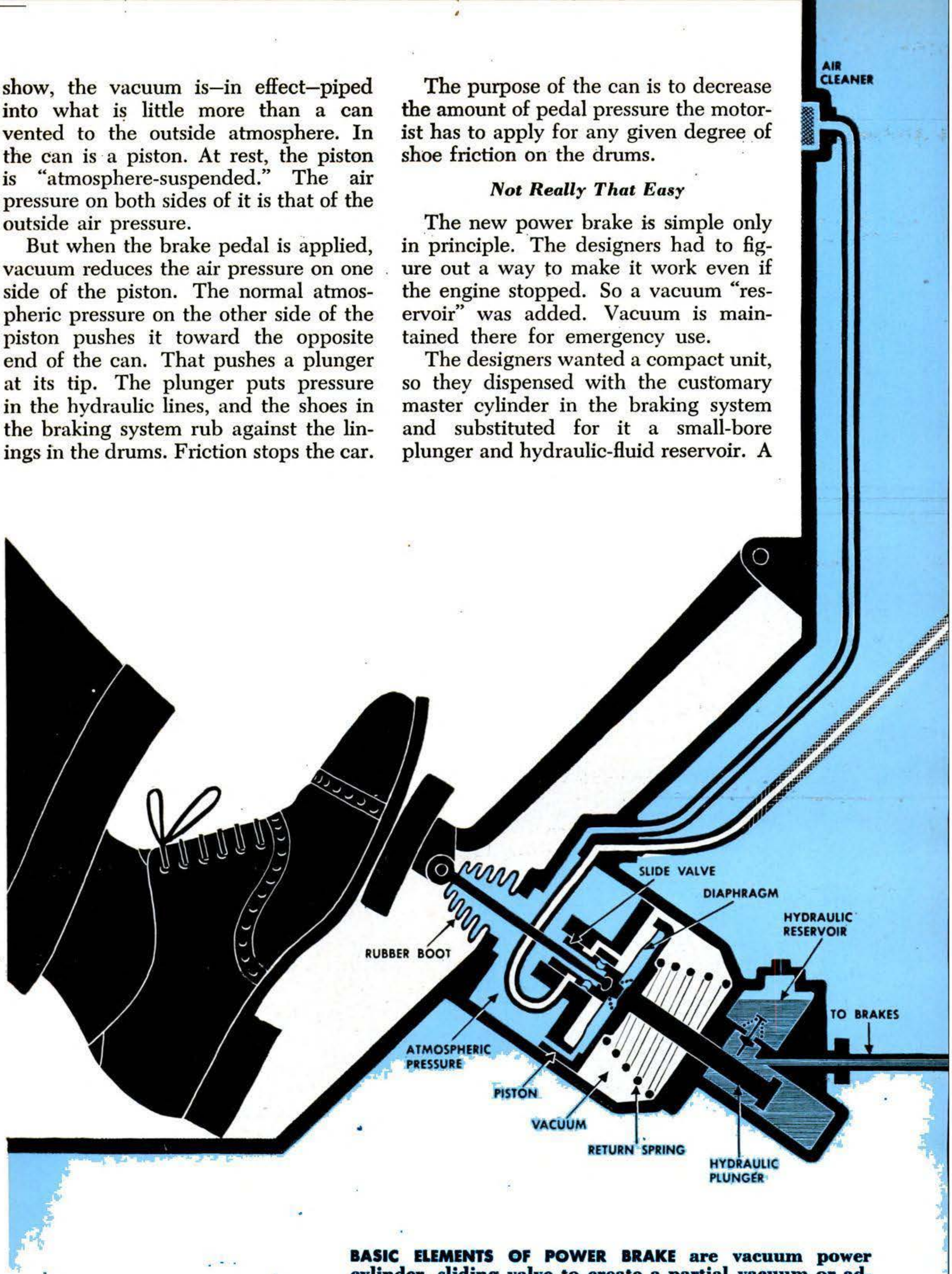
But when the brake pedal is applied, vacuum reduces the air pressure on one side of the piston. The normal atmospheric pressure on the other side of the piston pushes it toward the opposite end of the can. That pushes a plunger at its tip. The plunger puts pressure in the hydraulic lines, and the shoes in the braking system rub against the linings in the drums. Friction stops the car.

The purpose of the can is to decrease the amount of pedal pressure the motorist has to apply for any given degree of shoe friction on the drums.

Not Really That Easy

The new power brake is simple only in principle. The designers had to figure out a way to make it work even if the engine stopped. So a vacuum "reservoir" was added. Vacuum is maintained there for emergency use.

The designers wanted a compact unit, so they dispensed with the customary master cylinder in the braking system and substituted for it a small-bore plunger and hydraulic-fluid reservoir. A



BASIC ELEMENTS OF POWER BRAKE are vacuum power cylinder, sliding valve to create a partial vacuum or admit atmosphere, and hydraulic chamber with lines to brakes. When toe hits pedal, slide valve opens port to vacuum line. Atmospheric pressure pushes piston down.

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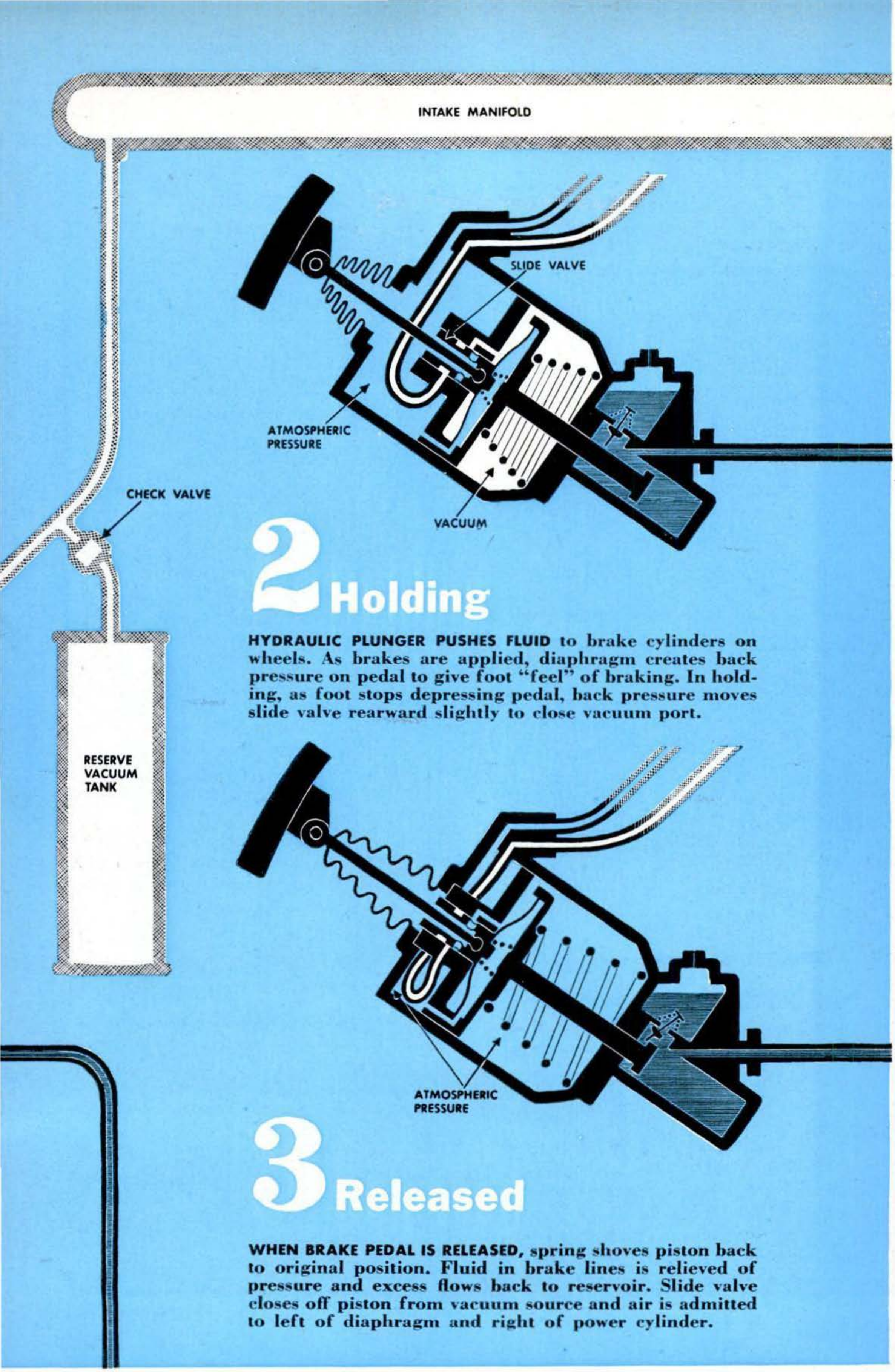

2 Holding

HYDRAULIC PLUNGER PUSHES FLUID to brake cylinders on wheels. As brakes are applied, diaphragm creates back pressure on pedal to give foot "feel" of braking. In holding, as foot stops depressing pedal, back pressure moves slide valve rearward slightly to close vacuum port.

3 Released

WHEN BRAKE PEDAL IS RELEASED, spring shoves piston back to original position. Fluid in brake lines is relieved of pressure and excess flows back to reservoir. Slide valve closes off piston from vacuum source and air is admitted to left of diaphragm and right of power cylinder.

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Facts on '52 Packard

Make and model: Packard Patrician "400" four-door sedan.

Engine: Straight 8 L-head; 155 hp. at 3,600 r.p.m.; car weight per hp., 26.5 lb.; bore and stroke, 3½" by 4¼"; compression ratio, 7.8:1; piston displacement, 327 cu. in.

Engine piston travel: (in feet per mile at 20 m.p.h.)—1,798.

Crankshaft bearing surface: 95.4 sq. in.

Torque: 275 lb.-ft. at 2,000 r.p.m.

Transmission: Packard Ultramatic.

Rear-axle ratio: 3.54:1.

Steering ratio: 22.3:1.

Radius of turning circle: 22½ ft.

Effective brake-lining area: 208.25 sq. in.

Springs: front, coil; rear, semi-elliptic.

Weight and outside dimensions: 4,115 lb.; height (normal load), 62 29/32"; overall length with bumpers and guards, 217¾"; width, 77 11/16"; wheelbase, 127"; overhang, front 36 25/32", rear 53 31/32"; tread, front 60"; rear 61 7/32".

Inside dimensions: seat-cushion width, front 62¾", rear 62"; leg room, front 43 13/16", rear 46½"; headroom, front 36", rear 35 3/16"; seat height, front 14", rear 13 27/32"; vertical distance, steering wheel to seat cushion, seat in full rear position, 5⅛"; front-seat adjustment, horizontal 4", vertical 1".

Tire size: 8:00 by 15.

spring-loaded valve at the bottom of the reservoir keeps the hydraulic lines full of fluid and stores the excess in the reservoir.

It was necessary to keep the piston in the can from going into action too fast under vacuum boost when a driver needed only a touch of brake to slow down.

So the piston, in effect, was cut in two and a diaphragm inserted. The diaphragm sets up a counterreaction to the effort of the outside air to push the piston down into the vacuum end of the can. They use vacuum for that, too. Normal air pressure flows into a space on the *downside* face of the diaphragm. Vacuum exhausts the air on the other side. So air pressure keeps trying to push the diaphragm—and the piston—back against the motorist's foot. That gives him a "feel" of braking.

In mounting "feel" as the pedal goes down, the new brake is unlike any other power brake in use today, whether it be air, electric or vacuum. The air brakes on trucks and combos provide a driver's foot with practically no feel at all.

Brake Pressure Mounts Smoothly

The new brake, standard on the Packard "400" series and optional on the company's other '52 models, is not the first power brake applied to passenger cars. But it is the first one that combines a power cylinder and a modified master hydraulic cylinder in one package. It is also the first passenger-car power brake that does not surge—suddenly give added friction of the shoes on the drums—as the brake pedal is depressed. The new brake applies mounting pressure on the shoes smoothly.

Primary design on the new power brake was done by Bendix. Packard collaborated on development work to adapt it to the '52 line of cars. END

75 years ago this month

Popular Science Monthly reported:

"THE University of Michigan had last year 101 female students, distributed as follows: Medicine, 37; law, 2; homeopathy, 2; literature, 60. 'The experience of the past year,' writes the president of the university in his annual report, 'confirms the opinion of former years, that women who come here in good health are able to complete our collegiate or professional course of study without detriment to their health.'"

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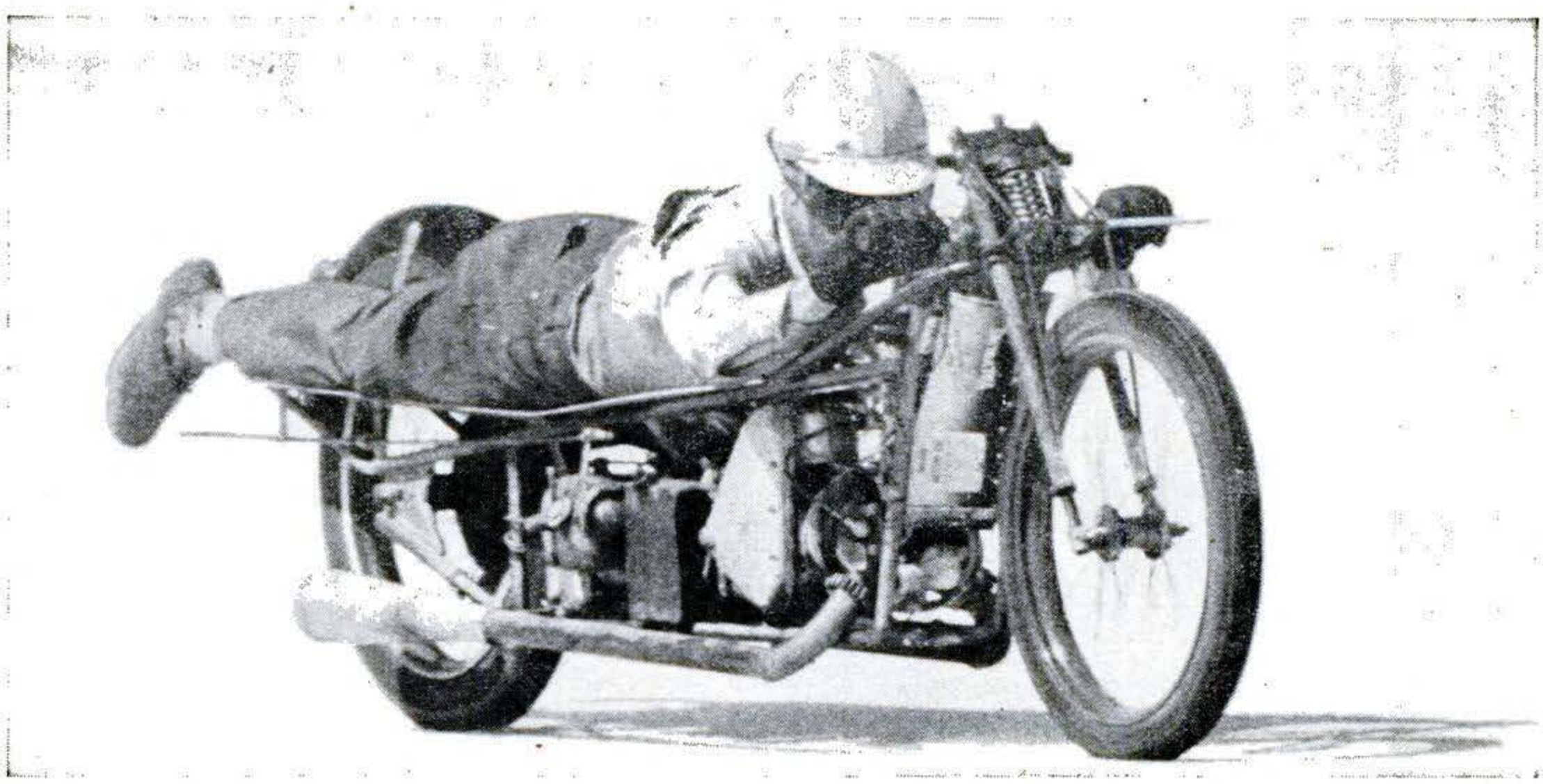
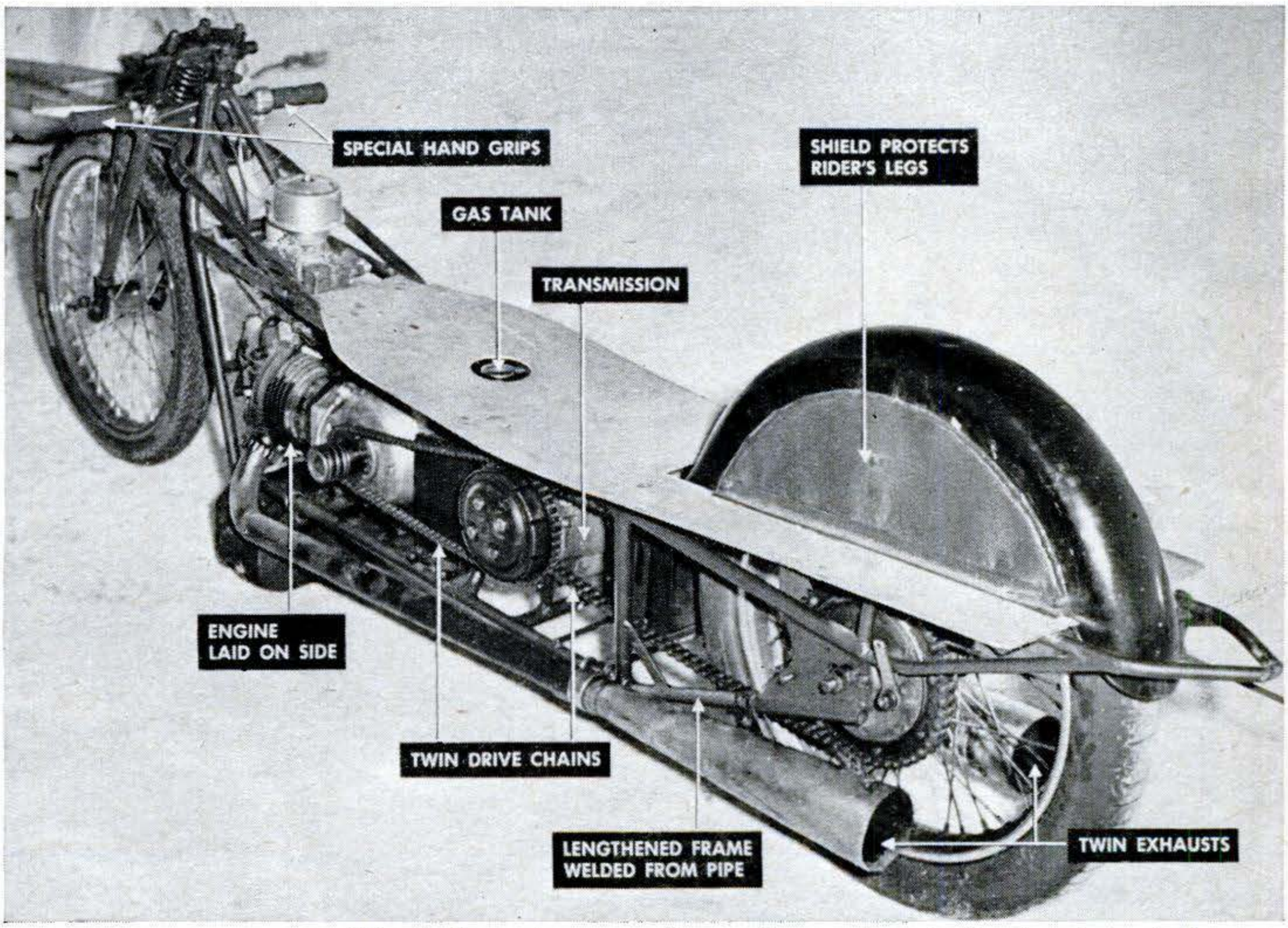


Bellywhopping 'Cyclist Sets 126-M.P.H. Record

RIDING a hopped-up Triumph motorcycle in bellywhopper style, Bud Hare of Santa Ana, Calif., recently set a speed record of 126.6782 miles an hour in the 30.5-cu.-in. class on Utah's Bonneville salt flats. To cut down wind resistance and gain speed, Hare lowered the two-cylinder engine by turning it on its side and installed a body plate so he could drive stretched out flat. The vehicle has an elongated frame made of welded pipe. Twin exhausts reduce engine back pressure. The photos are from *Cycle* magazine.



THE TRANSMISSION, moved back from the engine, is connected to it by a chain running from the engine shaft. Another chain connects transmission with rear-wheel sprocket.

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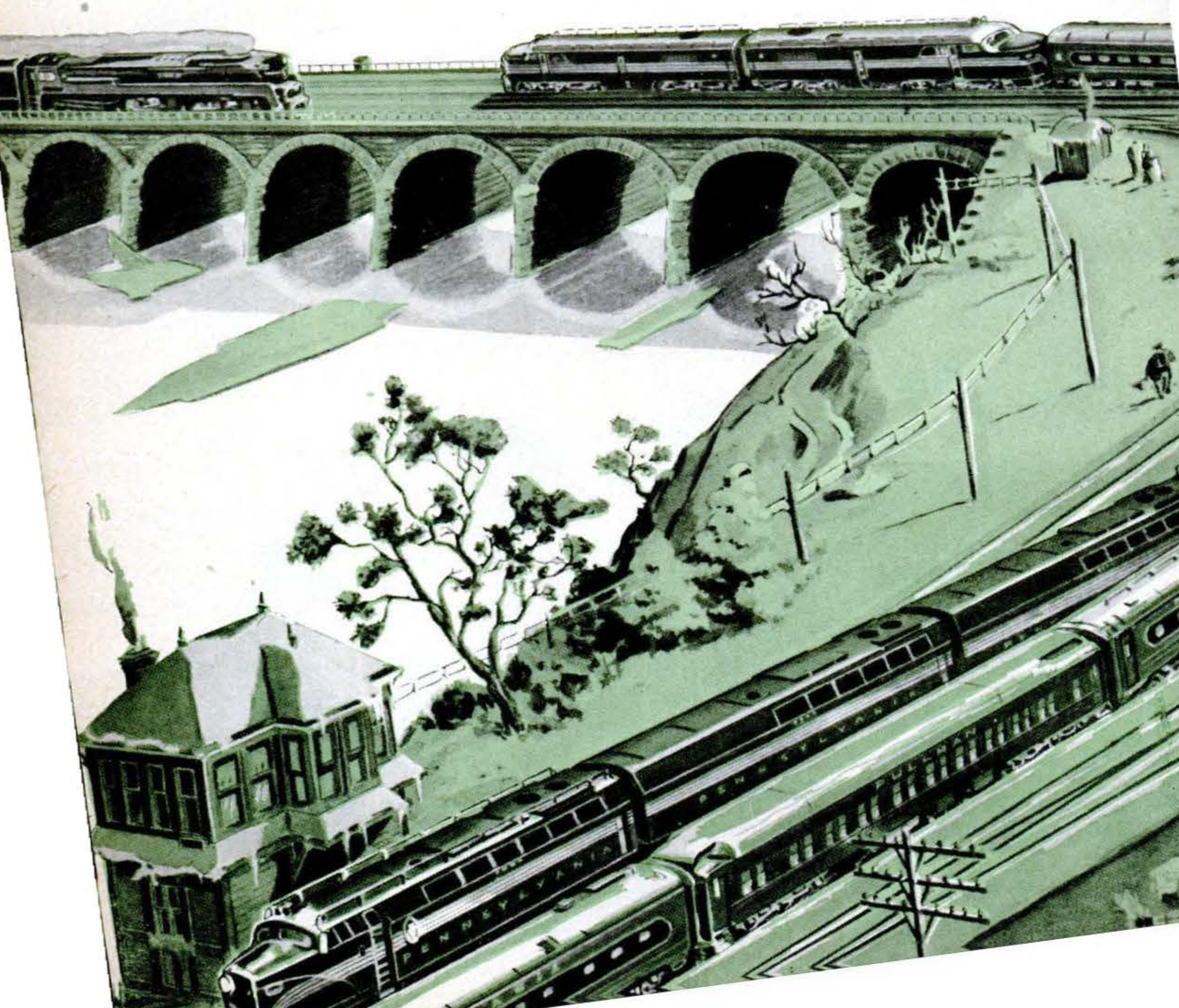
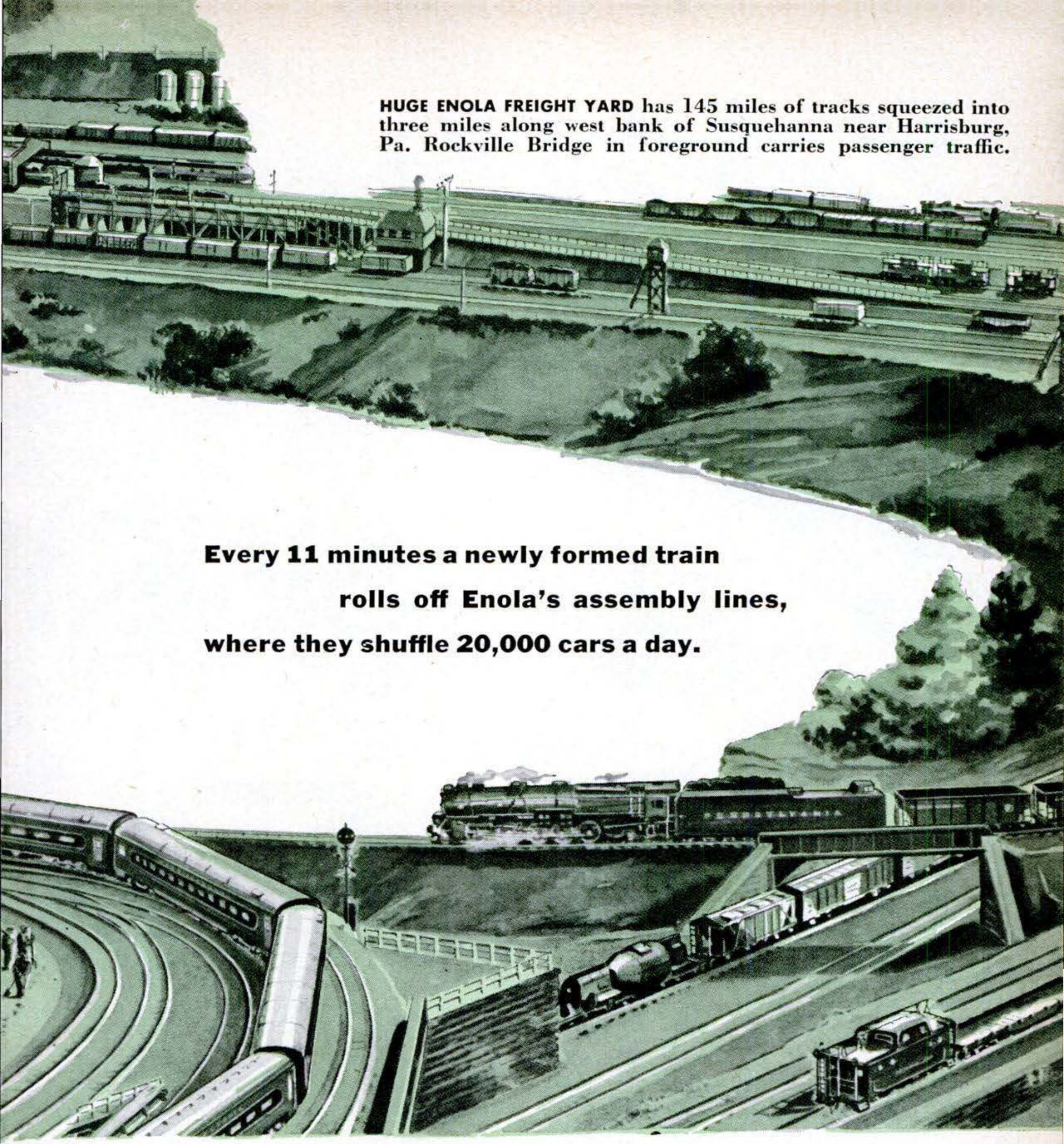
World's Fastest Freight-Train Factory

By Henry B. Comstock





HUGE ENOLA FREIGHT YARD has 145 miles of tracks squeezed into three miles along west bank of Susquehanna near Harrisburg, Pa. Rockville Bridge in foreground carries passenger traffic.

Every 11 minutes a newly formed train rolls off Enola's assembly lines, where they shuffle 20,000 cars a day.

ON THE Pennsylvania Railroad, which owns enough freight cars and locomotives to form a solid train reaching from New York City to Denver, there are 37 major terminals. Each one is a "hot garden," which is railroad lingo for a yard that barrels its traffic through with a minimum of holdover time.

But even on the Pennsylvania, one yard stands out like a circus car in a string of coal hoppers. Its very name, Enola, does double duty. Read it backwards and it spells *alone*. PRR officials will tell you that this huge terminal on the west bank of the Susquehanna River two miles north of Harrisburg, Pa., got its unusual name, not from its once-isolated location, but in memory of a division superintendent's daughter.

If so, the lady would hardly recognize her namesake today. For Enola's original 12 tracks, laid out in 1902, have now grown into 145 miles of terminal lanes, squeezed between three miles of river front and the concrete ribbons of U. S. Route 11, the Lee-Jackson Highway.

Stop your car at any one of a dozen van-

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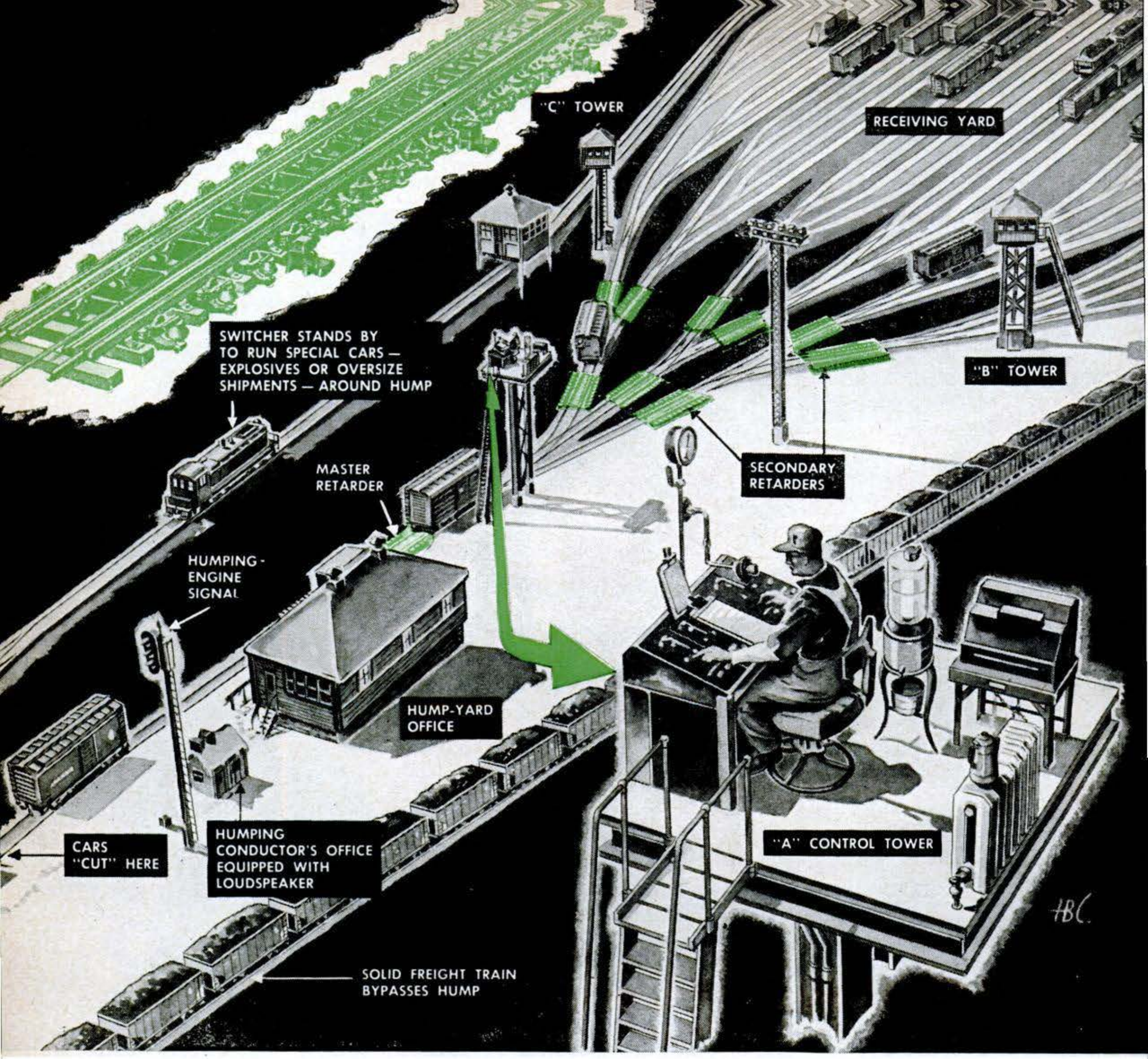

TOWER MEN control cars rolling down "hump" with "retarders," which grip wheels of passing car in pneumatic jaws. Color inset (top left) shows details of this braking device.

tage points along the road and you will see the vast yard spread out beneath you like a model railroader's Shangri-La. There is the inevitable red-brick yard office, a switching plant in itself, with endless reams of paper substituted for cars, and teletype machines for locomotives.

Across the way, a 43-stall roundhouse is sending up enough smoke signals to convince any skeptic that steam engines will not be replaced overnight on the Pennsy. Yet the handwriting is on the wall of the squat Diesel shop beyond. Looking more like a garage than a railroad plant, it inspects and overhauls the gold-striped newcomers on six tracks and at three platform levels.

Upriver, a thousand-foot coal dock is doling out bituminous in 40-ton tender loads; downstream a trim little substation does a different sort of fueling job for the big electrics that come humming in from the East. Between the two are acres of car-repair and paint shops, half a dozen control towers, and a tall-stacked powerhouse that compresses enough air in a day to fill all of the truck tires in the State of Pennsylvania.

One look at the layout, with its ceaseless flow of thousands of cars and scores of engines, and you understand the plight of the green switchman who complained: "How can you learn the tracks when you can't see them for the trains?"

"Don't think of this 'garden' in terms of switches and rails," Enola's yardmaster told him. "It isn't a yard; it's a factory. Only instead of turning out washing machines or automobiles, we're building 6,000-ton trains. Up at one end of the three-mile assembly

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line we get our raw material—the cars coming in from other terminals. First we check them for defects. Then we service every piece of equipment. These finished parts go onto the conveyor belt—the rails that pass over the 'hump.' That's the little hill at the center of the yard where we put gravity to work coasting the stuff down into the right spots at the right time—cars for Washington on one track, Baltimore on another, and so on through the list.

Train Factory Works Around the Clock

"The first thing we know, we have enough parts, picked out of perhaps 12 old trains, to make ourselves an equal number of new ones, all custom-built for terminals ahead. Now, bear in mind that we operate a second conveyor belt, moving in the opposite direction, assembling trains to go the other way. Keep them both working around the clock—and you've got Enola."

What makes Enola the hottest of "hot gardens" is the speed at which it runs those assembly lines. This terminal, with its capacity of 10,000 cars, can receive close to twice that number a day, shuffle them around like so many playing cards in the hands of a master magician, turn up each car in any order requested, and drop it into any one of six division superintendents' hats. It can completely reclassify a 100-car train in as little as 15 minutes. This, plus some through freights that do not need reclassification, enables Enola to turn out 130 complete trains in a 24-hour day—one every 11 minutes.

Minutes are no less important at Enola than in the cab of a speeding engine. If you don't believe it, climb aboard a freight car for a quick trip through the yard. Here comes Boston and Maine Number 33509, an empty flatcar, headed for home by way of Enola after an escapade that won her nationwide publicity.

More than a year ago the B & M started looking for this car to replace her antiquated braking apparatus. But, despite an efficient system that makes it possible for a railroad to keep an almost hourly check on the location of its cars, 33509 continued to race from division point to division point, eluding a "return to owner" order like a greased pig at a county fair.

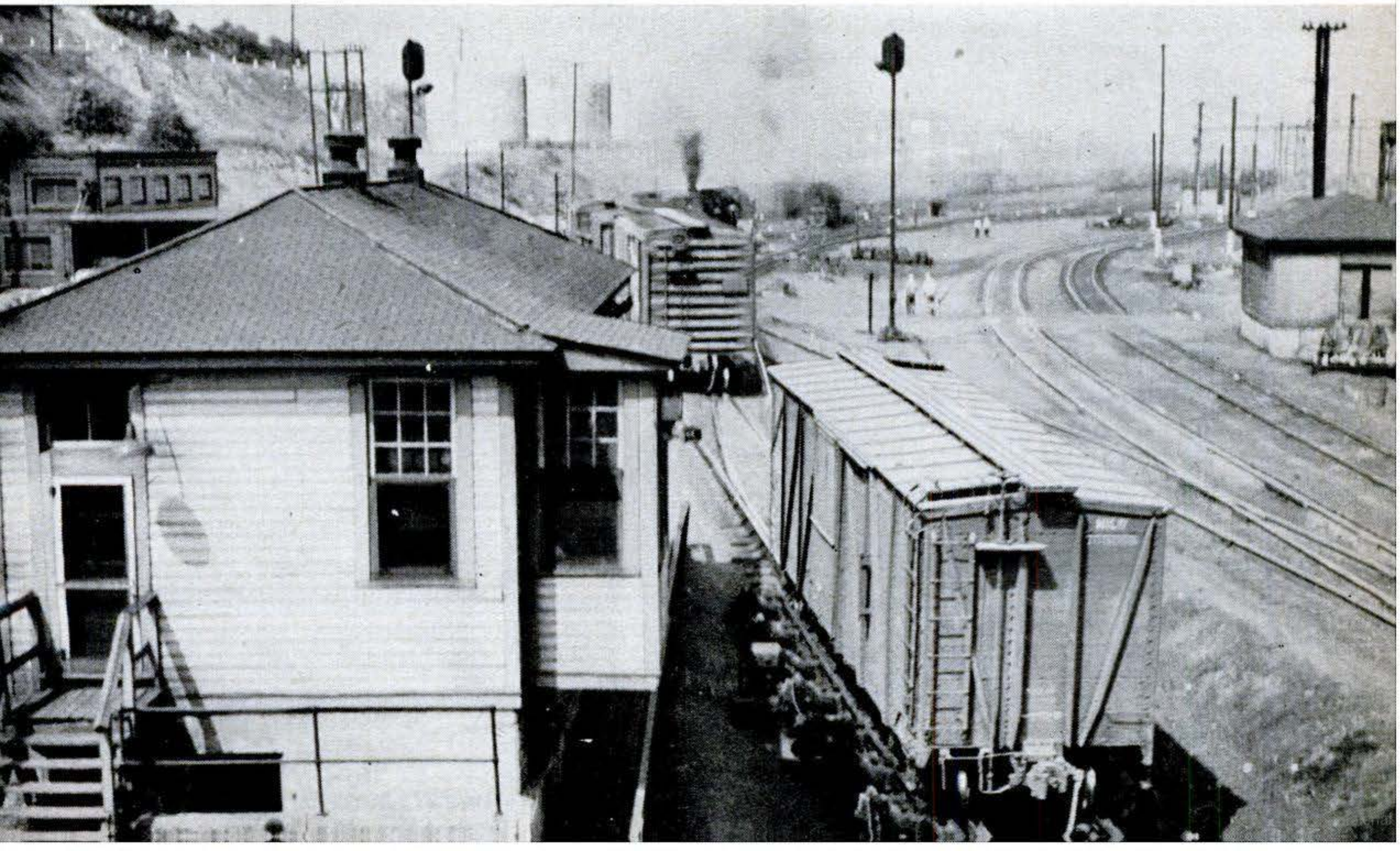
Number 33509 Approaches Enola

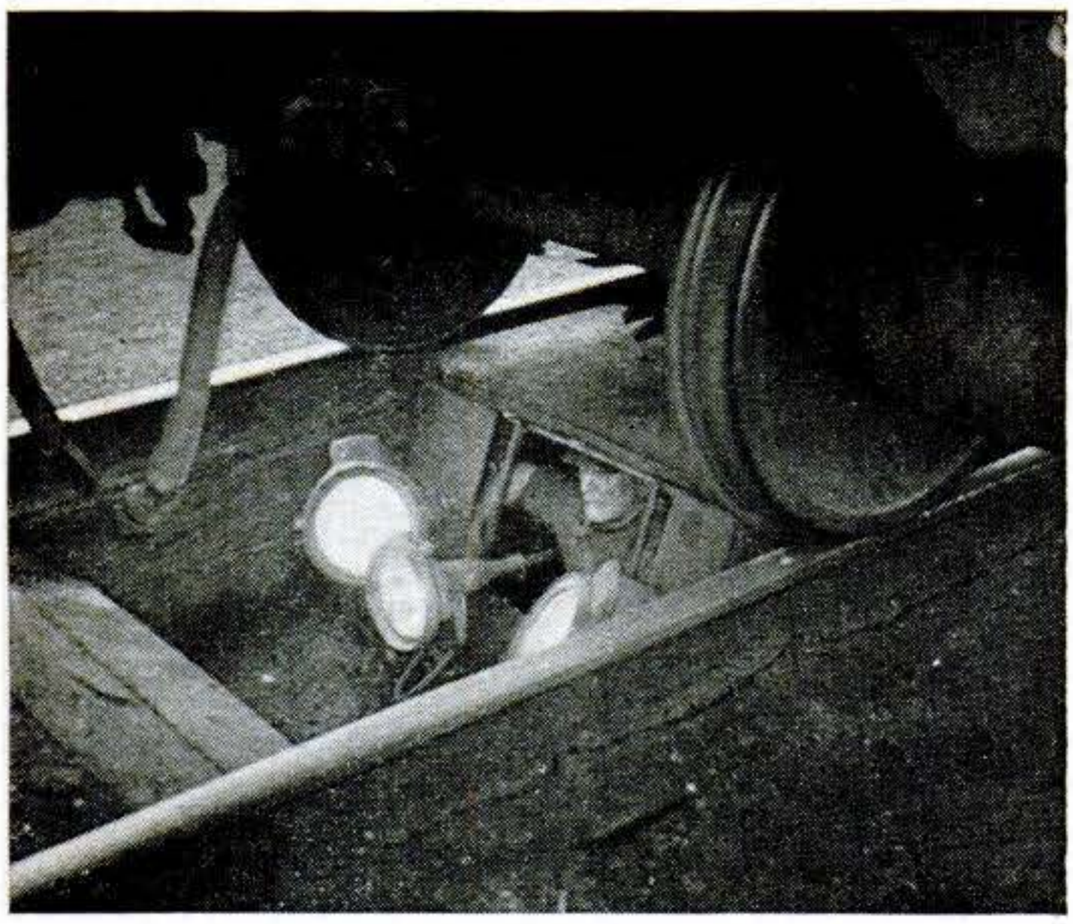
Intercepted at last, the boomer flat is now rocking along directly ahead of the caboose of a mile-long freight from Altoona. Under her wheels and over her deck, rails and line wires are crackling with train talk, picked up by induction telephone at both ends of the speeding merchandiser.

"Engineer to conductor of Caboose 478061."

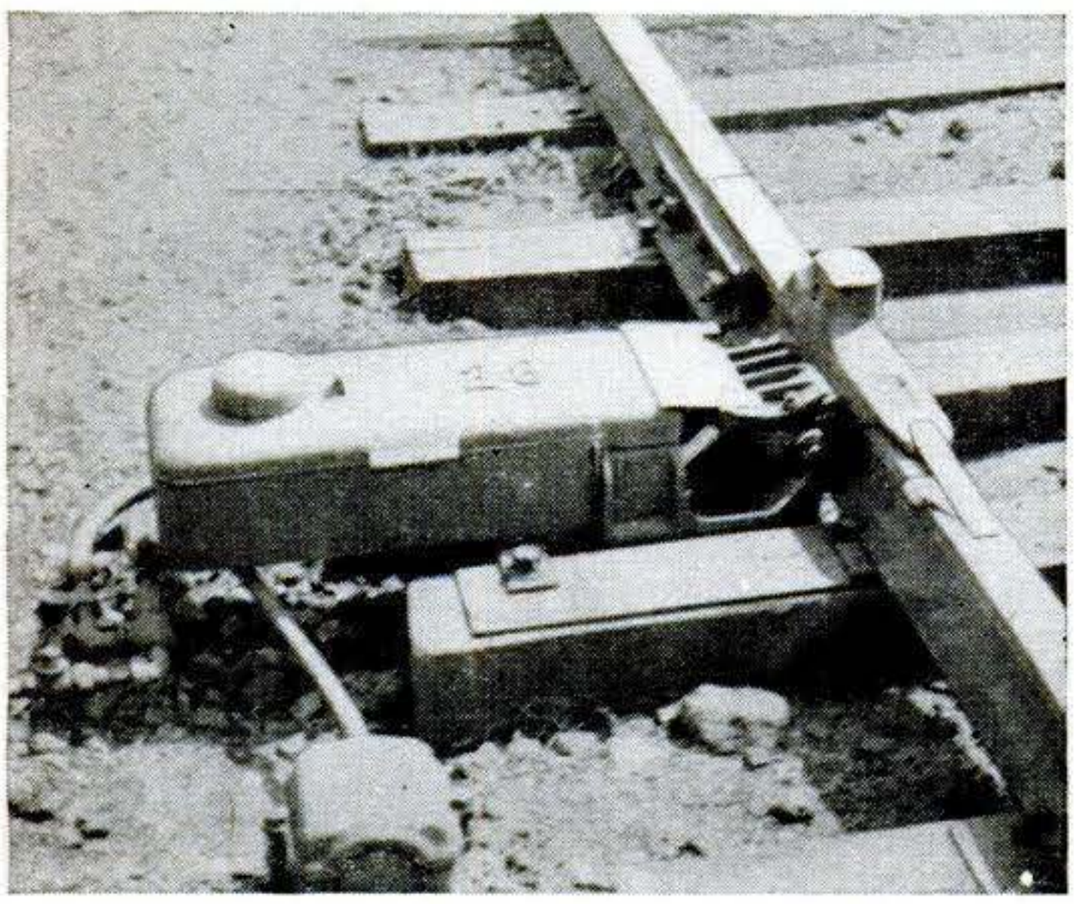
"Come in, Engine 2005. Only take your

FREE-ROLLING FREIGHT CAR lurches through master retarder as it starts down "hump" (shown on opposite page) where cars are fed by gravity into 34 classification tracks.

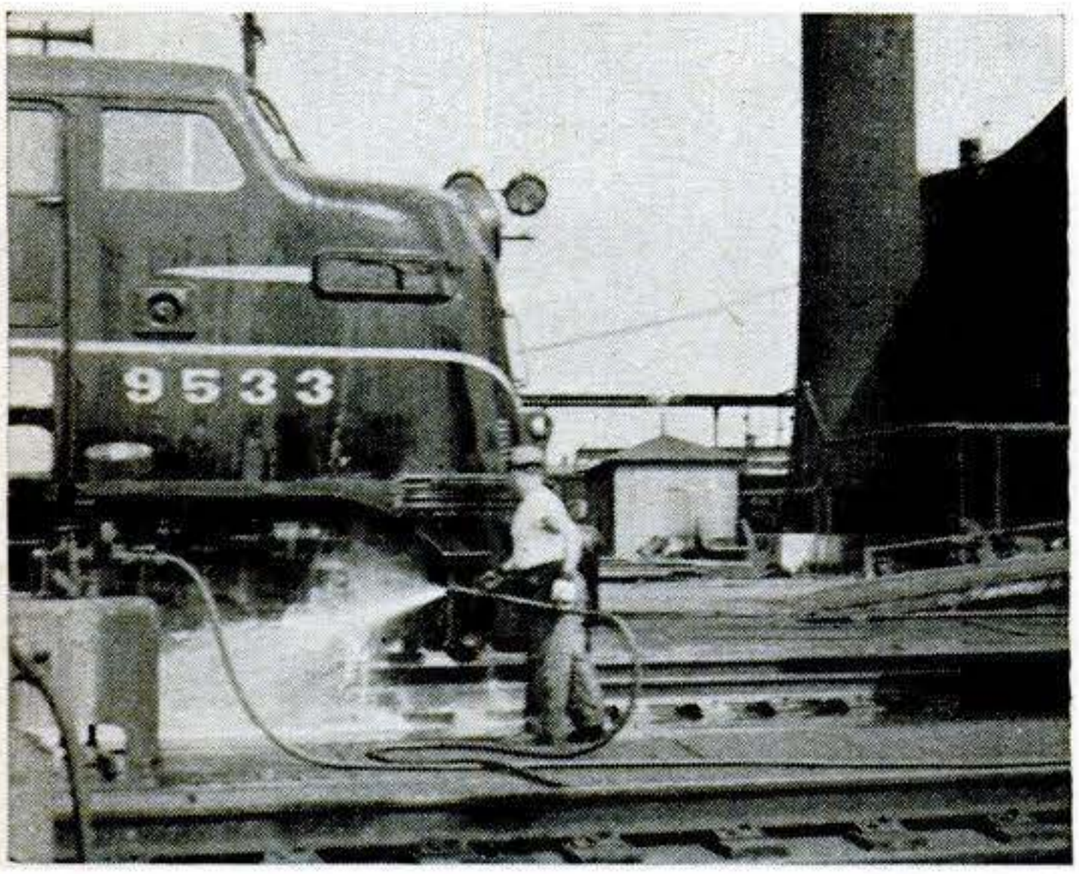




TRAINS PASSING THROUGH ENOLA without reclassification get a running inspection from the track pits. Defective underrigging is marked with a squirt of white paint.



ROBOT BRAKEMAN in the classification yard is this "skate." Placed on the rail at the touch of a remote-control lever, it skids rampaging cars to a quick stop.



LAUNDERING LOCOMOTIVES is part of Enola's job. After brushes and rinse hose are through, this Diesel will take on 4,800 gallons of oil for her next run to Chicago.

shoes off at the door: I just scrubbed the deck."

"Simmer down, Cinderella. Thought I'd remind you to keep an eye on that B & M flat. We're passing the spring switch south of Rockville. Time—11:37."

That point is the first of Enola Yard's 476 power and manually operated switches.

At 11:39 our flatcar and caboose are drifting by the same point. By now our engine is deep in the receiving yard. Just before the train grinds to a stop, a brakeman uncouples the caboose and lets it fall away.

Train Loses Its Head and Tail

The freight conductor drops to the cinders and races off to the yard office with a fistful of "wheel reports." These are the inventory of his train, the number of each car, its type, the name of the owner road, the nature of its contents, and its weight. Within 30 minutes Enola clerks will have converted the information into a "switch list" and sent it stuttering over their teletype machines to the control towers in the hump yard ahead.

Uptrack, a switching engine has tied onto the caboose and hurried it away to join a new train going back to Altoona. At the south end of the string of merchandise, Diesel 2005, a shark-nosed Baldwin job, grumbles off to the engine-servicing yard.

11:50. A crew of car inspectors moves in and sets up blue flags at both ends of the now headless and tailless freight. Those flags are the "men-at-work" sign in all railroad terminals from Bangor to San Diego, and until they are removed from the rails no locomotive will enter the track. Quickly the inspectors bleed off the air to release the brakes, uncouple the hose connections between cars, and check for hotboxes.

Cars Move Toward "Hump"

An alert eye spots the thin seam of a fractured truck casting. Down come the blue flags. The hard-working switcher glides back, cuts out the "cripple" and noses her away to a 330-car-capacity repair yard.

At 12:25 a 10-drivered humping engine noses to a joint with B & M 33509. An inspector calls to the engineer.

"Hey, Sea Biscuit! Look what you've got ahead of you—that old hoodoo 33509."

The humping engineer grins, looks far downtrack and sees the hump-yard signal on its tall mast blink from red to yellow. Cautiously he cracks the throttle and the cars

[Continued on page 262]

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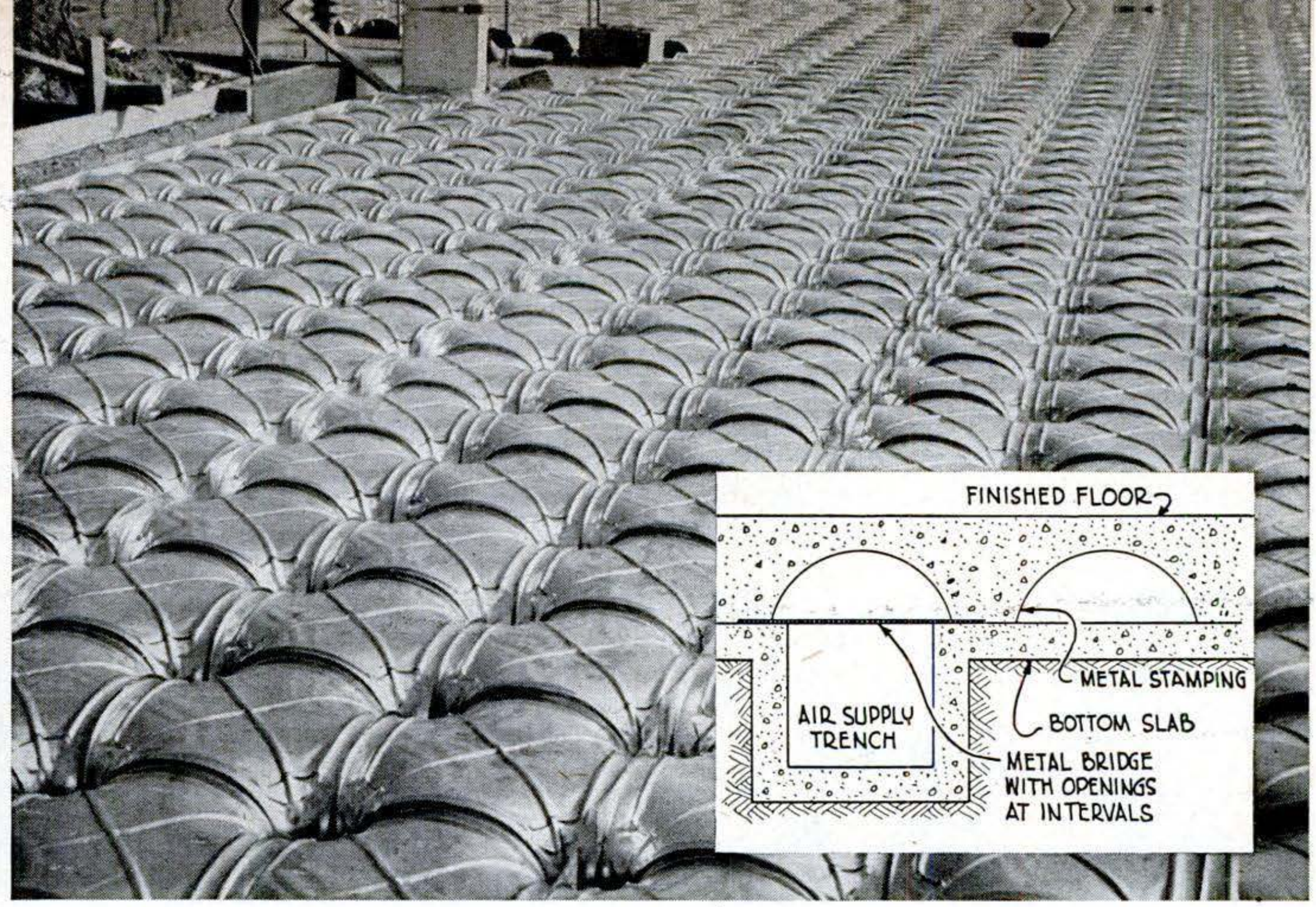
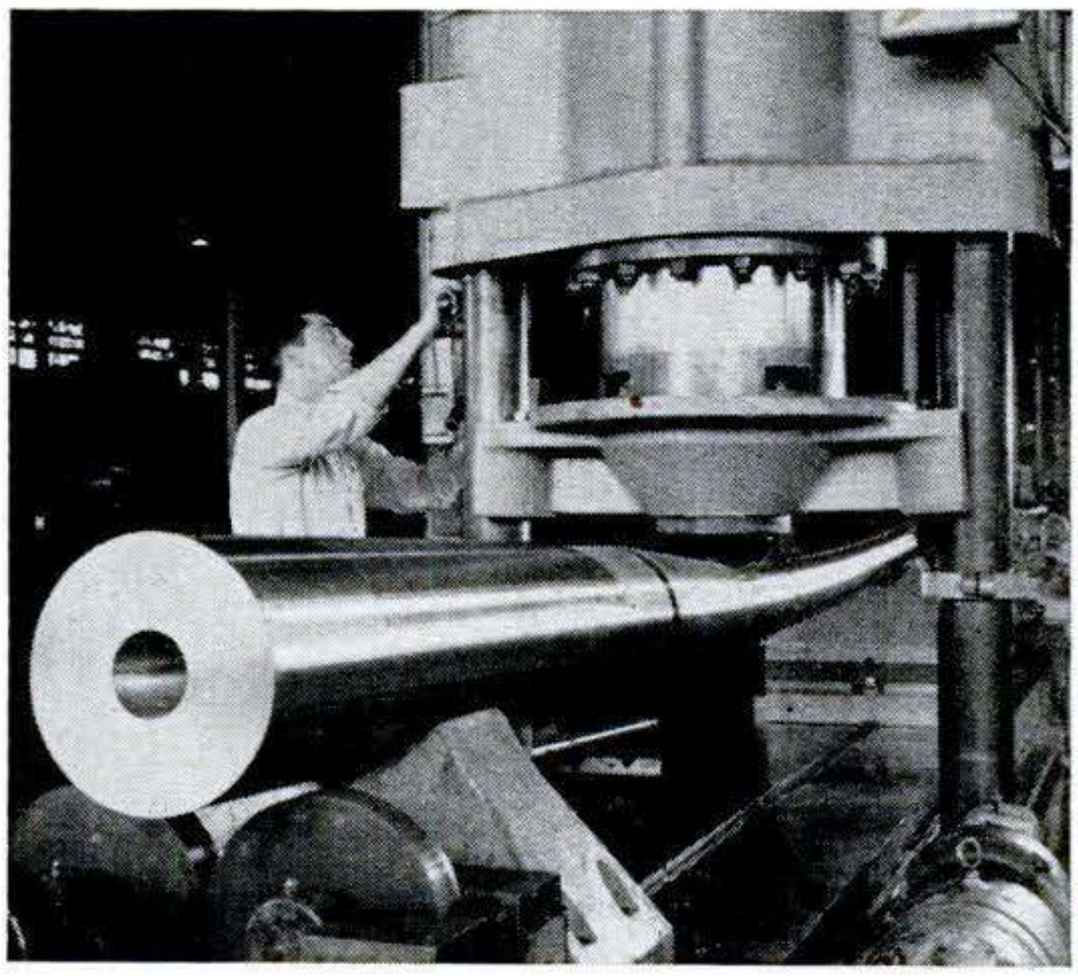


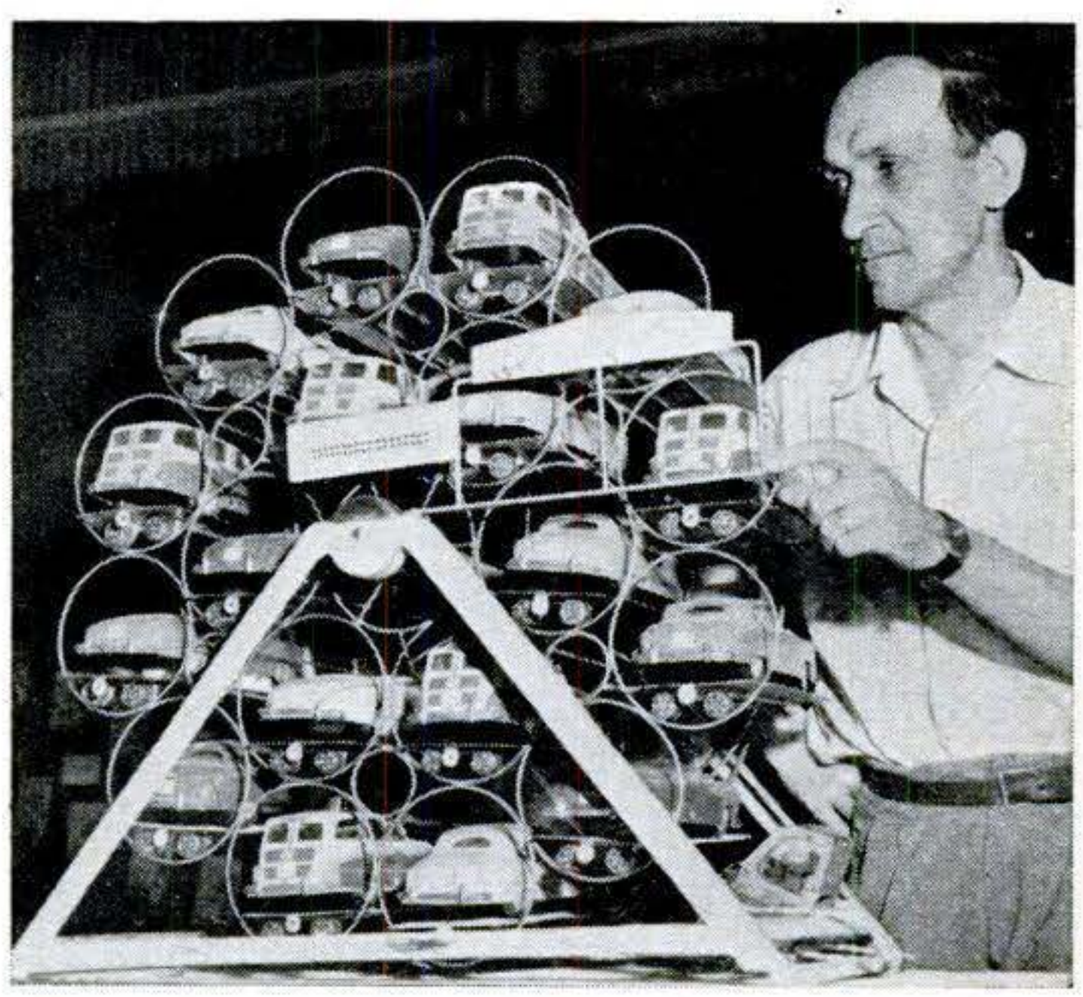
Hollow Floor Supplies Heat

THE ancient Romans' system of radiant heating—warm air sent through a hollow floor—has been brought up-to-date for modern buildings. Now the hollow floor is made of foot-square metal stampings of arched shape (photo above), which are laid on concrete. Concrete poured over them completes the Airfloor. Trenches lead warm air into the stampings from the furnace. Warm-air registers, although not essential, may help the system get heat up quickly.



A Cannon Goes on a Bender

WHEN 25-ton pressure puts a half-inch bow in the 90-mm. tank cannon above, it isn't being remodeled to shoot around corners. Release the pressure, and it will spring back ruler-straight. These cannons, which warp in machining, are bent true to within the Army's prescribed .002-inch tolerance by this mighty hydraulic press in the Firestone armament plant at Akron.



Ferris Wheel to Park Cars

TO SOLVE motorists' parking problems in cities, an Italian inventor proposes Ferris-wheel parking lots like the model above. Within a wheel turned by a seven-horsepower motor, platforms remaining level on rollers would hold 18 cars. The device could deliver one car a minute and would occupy only 860 square feet. Ramps on two levels would serve concentric rings of platforms.

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Experts Pick 1951's

What was the biggest news from the laboratories and workshops of the scientists this year?

If you were to ask 10 of America's best-known science reporters—as POPULAR SCIENCE has done—you would get 10 different answers to this question. The 10 journalists to whom the question was put are pictured below. All of them are members of the National Association of Science Writers. They cover

Wm. L. Laurence, *New York Times.*

Arthur J. Snider, *Chicago Daily News.*

Watson Davis, *Science Service.*

Wm. S. Barton, *Los Angeles Times.*

Paul F. Ellis, *United Press.*

Medical Advances Vie With Fantastic Weapons

More was learned this year about new drugs, dreaded diseases and nature's methods—as well as atomic warfare.

By Hartley E. Howe

NINETEEN HUNDRED AND FIFTY-ONE may be remembered by your grandchildren as the year that more atomic weapons were developed. It also may be remembered as the year in which:

- Ways were found to make wonderful new drugs plentiful.
- New concepts and techniques led to more advances in the science of prolonging human life.
- Men began to control the weather, and found a key to the method by which plants turn sunshine into food.

Arthur J. Snider, science editor of *The Chicago Daily News,* believes that "the disclosure that the Armed Forces can be successfully atom-powered is the year's biggest science news.

"With small atomic artillery capable of firing into concentrations of troops, the ways of tactical warfare are to be revolutionized," he explains. "No longer will splitting the enemy into small segments be the aim of ground warfare. Attacking armies will now try to force large numbers of the enemy to mass.

"Areas that have in the past been able to withstand weeks and months of siege can now be obliterated in days or hours. Mass amphibious landings may no longer be possible. American scientific and technological brains—our greatest weapon—have come up with the answer to Russia's superiority in man power."

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Biggest Science News

science news the way Washington correspondents cover politics and police reporters cover crime. They have spent the past year interviewing scientists, attending scientific meetings and studying scientific reports to obtain the news of science for the readers of the newspapers, press associations and magazines that they represent. The stories that they consider this year's biggest news are summarized in the article that follows.

Alton Blakeslee, *Associated Press.*

George A. W. Boehm, *Newsweek.*

Gobind B. Lal, *American Weekly.*

Victor Cohn, *Minneapolis Star.*

Nate Haseltine, *Washington Post.*

Victor Cohn, of *The Minneapolis Tribune* and *Minneapolis Star,* says "the biggest science story of the year was Senator Brien McMahon's recommendation that the United States increase six-fold its annual expenditure on atomic weapons."

This means, he believes, that we must be producing fissionable material faster than the public has supposed, that new sources of fissionable material must be available, and that atomic energy for industrial use may be nearer than we realize.

William L. Laurence, of *The New York Times,* was the first science writer to see an atom bomb go off, but he differs with those who consider atomic developments the biggest science news of 1951.

He considers the synthesis of the basic steroid from which cortisone can now be made the big story this year. Cortisone (PS, June '51, p. 97) is one of the hormones which have produced remarkable results in treating arthritis and other diseases. This year a team of chemists at Harvard, led by Prof. Robert B. Woodward, developed a way of making a basic steroid from a simple coal-tar derivative. At almost the same time, another Harvard research team found a way to close a missing link in the chain of processes between the steroid and cortisone.

Paul F. Ellis, science editor of the *United Press,* considers another story about cortisone the year's biggest science news. This was the synthesis of cortisone from a wild Mexican yam by a group of Mexican scientists led by Dr. George Rosenkranz.

"This," says Ellis, "may well mean that the wonder hormone drug will eventually be as cheap as an aspirin tablet."

And he adds: "The Mexican scientists believe that the new synthesis will enable science to make other hormone substances that may have more value than cortisone, or possibly a better cortisone."

Nate Haseltine, of *The Washington Post,* was most impressed by a new basic theory about arthritis. Developed by a research team headed by Dr. Thomas McPherson Brown of George Washington University, this concept is based upon the discovery of living organisms called "L-organisms."

Dr. Brown describes L-organisms as half virus and half bacteria. They live inside the cells of the body. There they multiply and move out into the spaces between the cells as antigens. These antigens provoke the defense forces of the human body, the anti-

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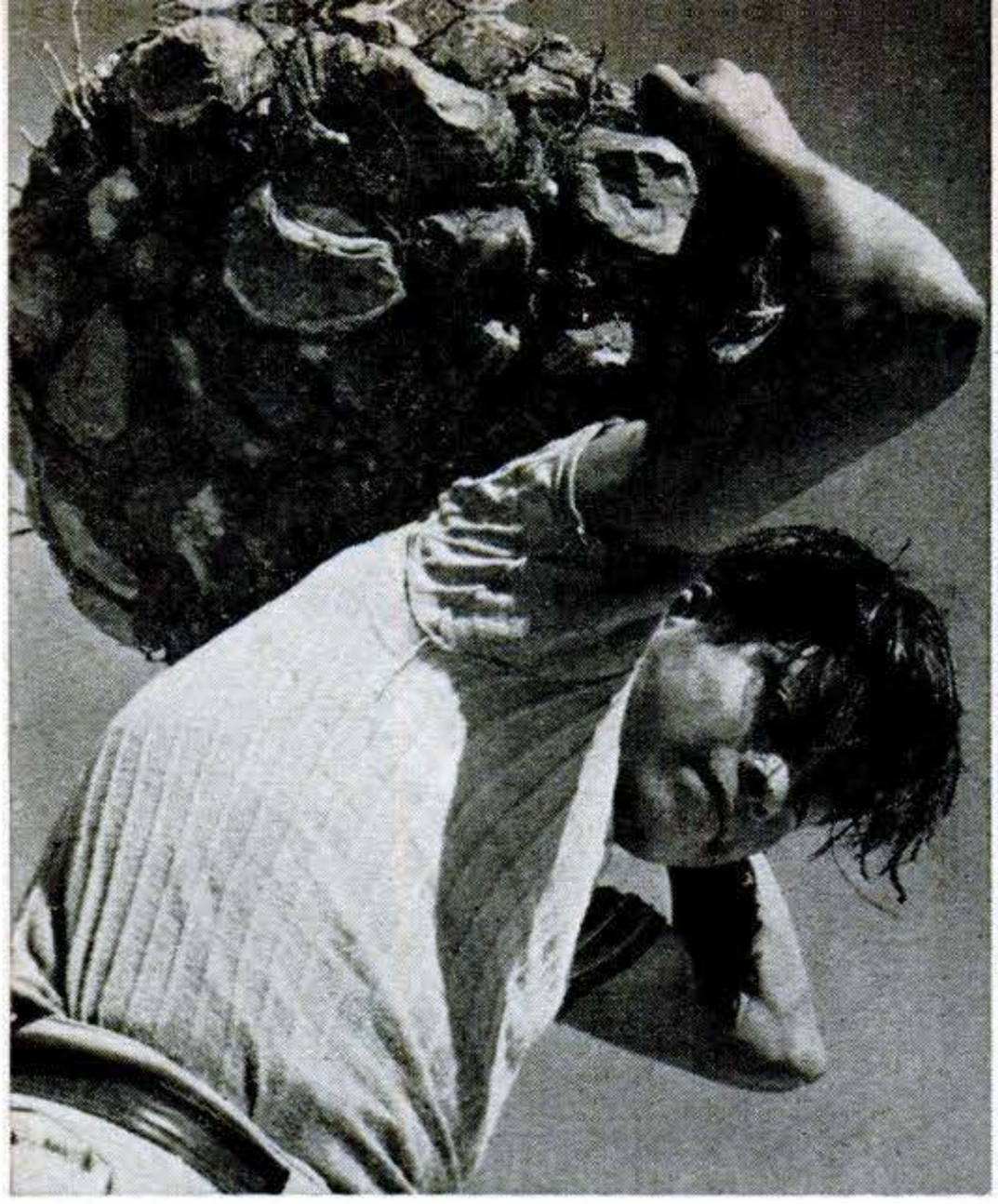

THE BLACKHEAD YAM that this Mexican boy is carrying is raw material for cortisone in a process developed this year. The inedible yam grew wild, now is being cultivated.

THIS BABY WAS DYING of meningitis when his parents in Scotia, N. Y., read of a new treatment using bacitracin. The antibiotic saved Michael Zielinski's life.

bodies, into action. The war between the two, according to the theory, creates a state of hypersensitivity, especially in the joints. This is the cause of the agonizing pains, swelling and crippling effects of arthritis. Cortisone, Dr. Brown believes, acts as a "blocking agent," keeping the antigens and the antibodies apart so that the reaction between them does not take place.

"This theory provides the first explanation of why cortisone and ACTH work only temporarily in relieving arthritic pains and crippling," Haseltine says. "If the concept proves out, it might also explain similar causes of such baffling diseases as cancer, polio, muscular dystrophy and many other maladies."

Alton L. Blakeslee, science reporter for the *Associated Press,* calls attention to the discovery of substances in mother's milk that destroy viruses of many diseases. A pair of chemicals turned up by Dr. Albert Sabin of the University of Cincinnati act as antibodies against the viruses of encephalitis, yellow fever, dengue fever and cold sores. Dr. Sabin had previously found in milk an antibody against polio. The chemicals are found only at intervals, and only in certain mothers. Whether the antibodies protect babies against disease, is still to be discovered.

"I like this story because here is a first-class scientific mystery, a new line of investigation into nature's secrets," says Blakeslee. "The work is potentially of great practical importance—or it may be just the discovery of some scientific curiosities. As with other basic research, no judgment can be made right now whether these discoveries will prove useful."

Gobind Behari Lal, science editor of *The American Weekly* and Hearst Newspapers, chose a quite different kind of medical story. "Entitled *Brain Fever Treatment,*" says Lal, "it related that severe meningitis with pus, caused by certain types of bacterial organisms which did not respond to most known treatments, was cleared up in a number of cases by the use of the antibiotic called bacitracin."

When the parents of 10-month-old Michael Zielinski, dying of meningitis in a Schenectady hospital, read this story in *The American Weekly,* they insisted that Michael be given bacitracin. The baby was completely cured.

"Now these folks believe in science stories," Lal declares. "That is important. Maybe when the two-and-a-half billion earth inhabitants become one percent familiar with the usefulness of a scientific approach to the problems of man, the cure for war and tyranny will be somewhat near."

William S. Barton, science editor of the *Los Angeles Times,* found the year's big news in another aspect of medical research. He nominates an improvement in a test for cancer that enables it to be done with common materials. "I know of no story more important than one that indicates that it

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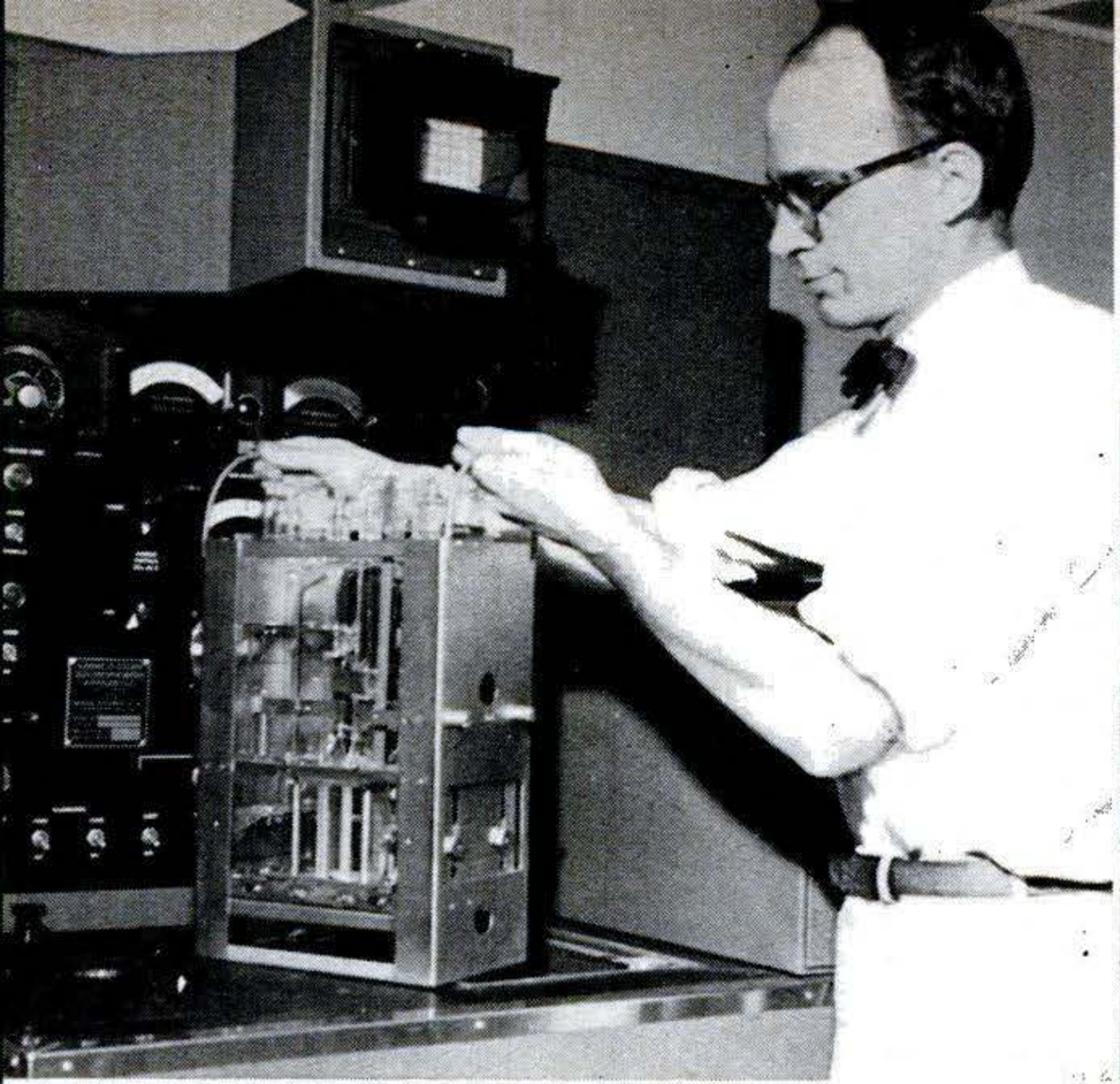

PATIENT'S BLOOD IS ANALYZED in electrophoretic machine by Dr. W. R. Merchant, member of medical team led by Dr. T. M. Brown: research lead to new arthritis theory.

WAS RAIN-MAKING in the arid West linked to this flood in Kansas River Valley? Nobody knows for sure, but weather-making went commercial on a big scale this year.

soon will be possible to diagnose cancer at such an early stage that cures are almost certain to be effected," Barton explains.

The test is the result of many years of research by Dr. Harry S. Penn, a practicing physician. The test originally required an extract made from the livers of persons who had just died of cancer. Now Dr. Penn has found that it can be prepared synthetically from a common organic substance. This may bring the cost down to 25 cents a test, cheap enough for it to be used to screen whole communities at a time.

George A. W. Boehm, *Newsweek's* science editor, believes that the attempt to control weather in large parts of the West by cloud seeding was this year's biggest science news. "Its consequences," he maintains, "are sure to be even greater than those of the atom bomb. Control the atom and you can win battles; control the weather, and you can have the whole world at your mercy."

Leading figure in the commercial rain-making was Dr. Irving P. Krick, of Denver. His contracts for the summer of 1951 covered 436,800 square miles.

The operations of all the weather makers, including Krick, are highly controversial. Do they work? If so, should they be licensed and controlled? Were rain makers responsible for the disastrous Kansas floods? "It may take years to decide whether Krick should be drawn and quartered or canonized," says Boehm, "but despite its lack of a conclusive ending, I nominate the story of his enormous gamble as the biggest science story since the atom bomb burst over Hiroshima."

Watson Davis, director of *Science Service*, also feels that his choice may outweigh the atom bomb in long-term importance. It deals with the mysterious way in which plants are able to use their green leaves to transform sunlight into food.

A new theory to explain this was announced this year by Dr. Dean Burk, of the U. S. National Institutes of Health, and Otto Warburg, Nobel prize winner. Crux of the problem is that it takes at least three units of energy to manufacture one molecule of carbohydrate, the food the plant makes from sunlight. Yet sunlight supplies only one unit of energy at a time. Now the researchers have found that each unit as received activates an unknown substance in the plant to start a chemical reaction. Three reactions produce a carbohydrate molecule.

"The meaning of this discovery may prove to be as significant as the fissioning of uranium discovered in 1939," Davis believes, and he adds:

"Possibly a sort of artificial green plant, capable of factory use, can be developed to apply industrially the capture of the plentiful sunshine. If this can be done, economically, the world would be freed of its dependence for energy upon coal, oil, gas, wood and other fuels and synthetic food should be just around the corner." END

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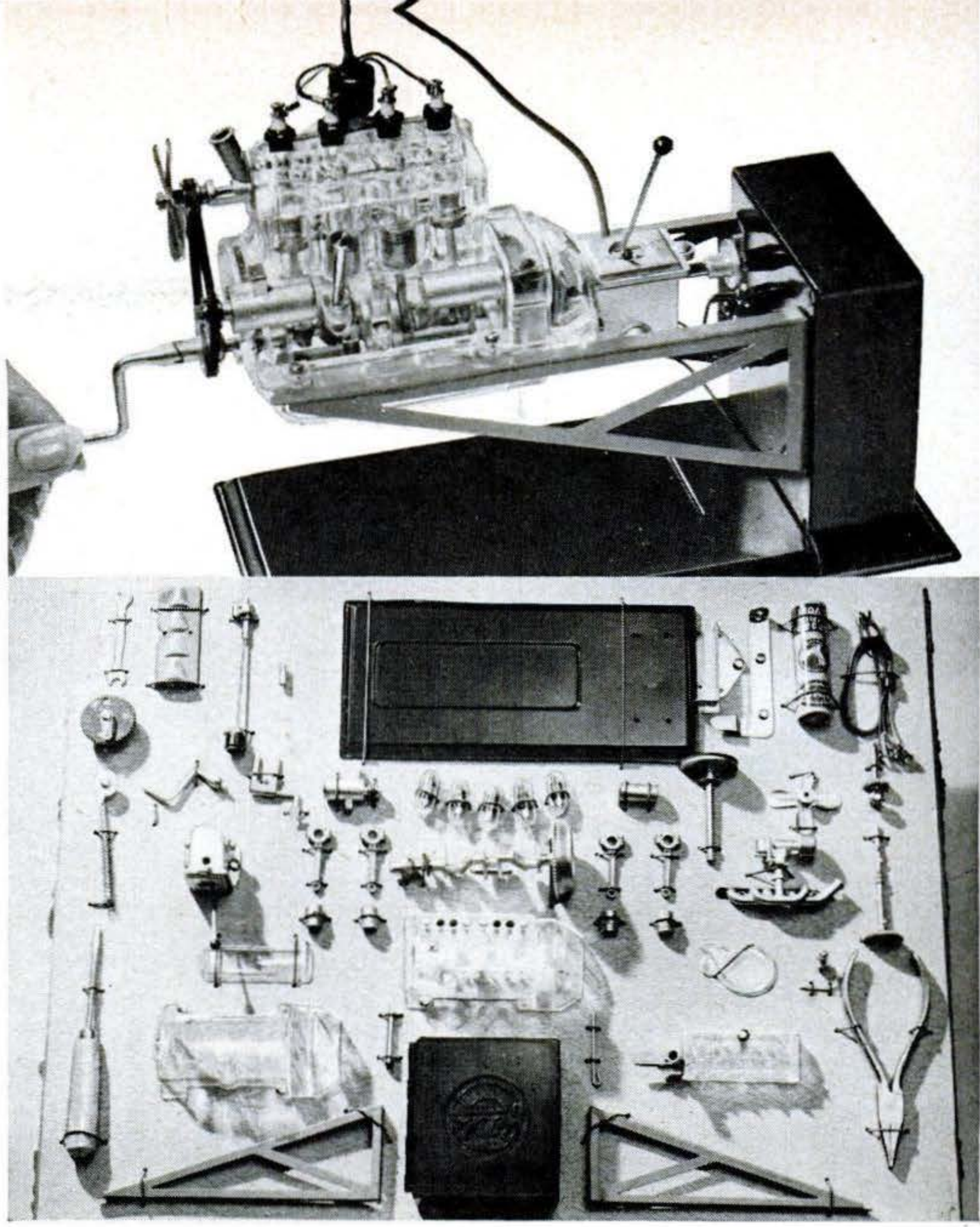
Spark Plugs "Fire" in Transparent Model

A DREAM gift for mechanically inclined youngsters, this imported kit contains all the parts for a transparent four-cylinder engine. When assembled, the little auto engine can be turned over by crank, giving a clear view of the crankshaft and piston action. Intake and exhaust valves are opened by a tiny die-cast camshaft. Miniature red lamps that resemble spark plugs flash on the power stroke in each cylinder. Dry-cell batteries are concealed in the plastic case at the end of the motor mount.

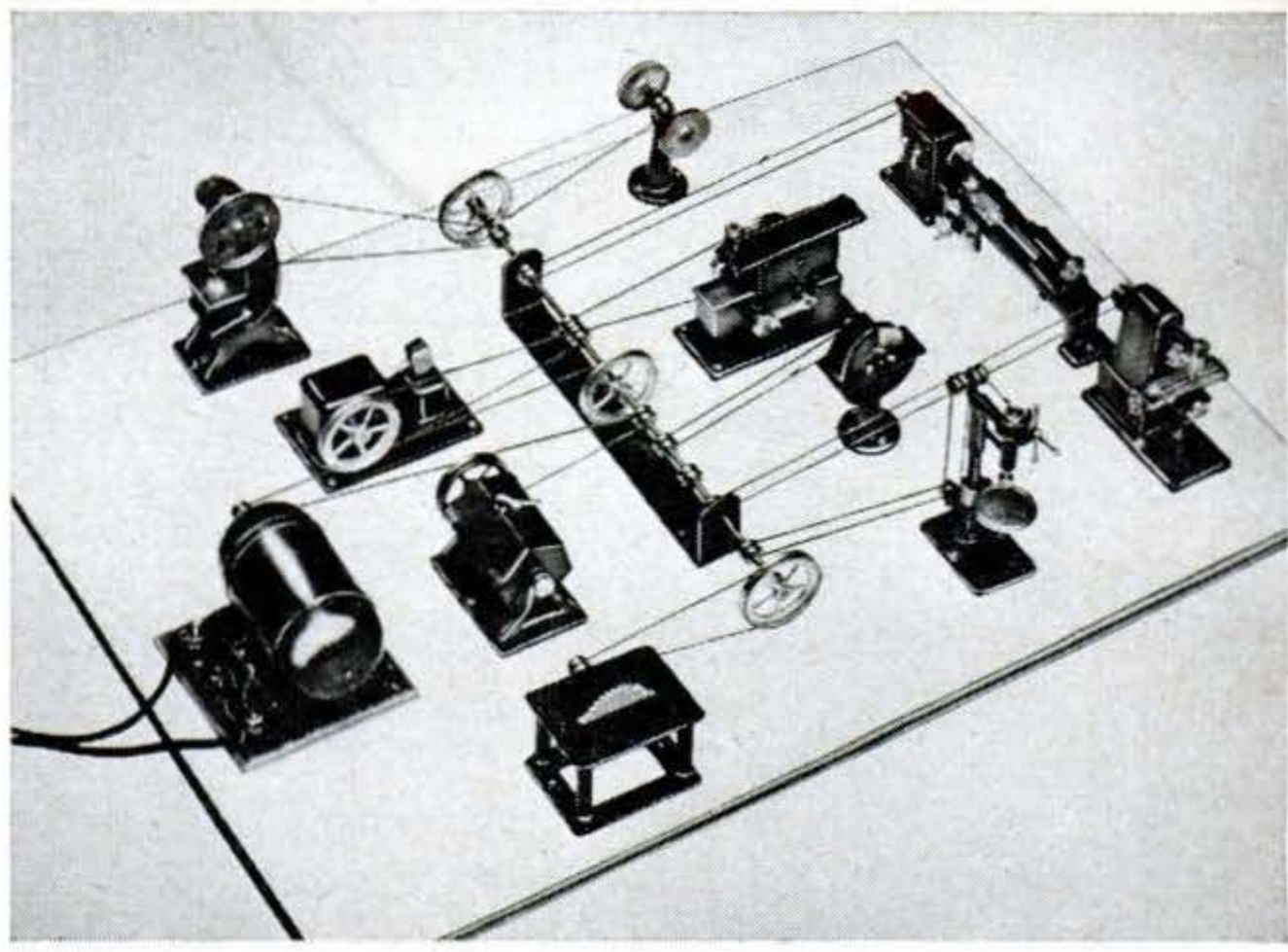
The model has a generator, fan, carburetor, starting motor, fuel pump—even an oil-filler pipe and dipstick. There's a working clutch and a dummy transmission with movable shift lever. Assembling the engine is likely to keep a 12-year-old quiet for a good many hours.

Made in Germany, the kit is distributed in this country by Reiss Bros., New York City, and retails for about $22.



Battery Signals Fouls in Game

AN ELECTRIC battery referees the play in this new version of an old game. Tweezers, used to lift jack straws through holes, are connected to a battery in the box. If the tweezers touch the metal cap, a light flashes on and a buzzer sounds. The Electric Game Co., Holyoke, Mass., makes the toy.



Machine Shop Fits on a Table

THIS miniature machine shop has 10 scale-model machine tools that work just like life-size ones. A tiny electric motor powers all the tools, which are die-cast in zinc. An import from Denmark, the set is sold in kit form by the Bell Products Co., New York City. It costs about $15.

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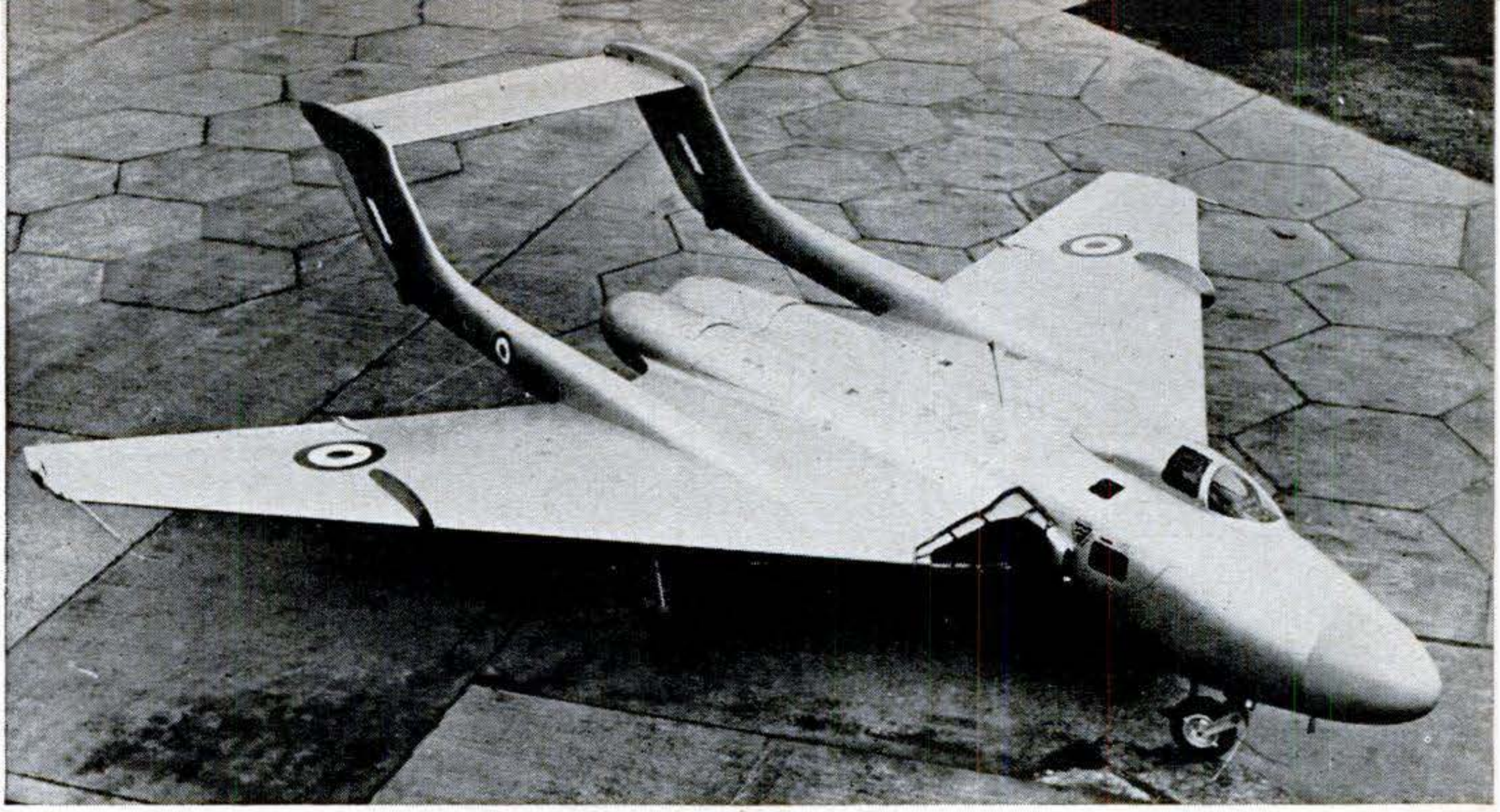


Britain Unveils Twin-Boom Jet

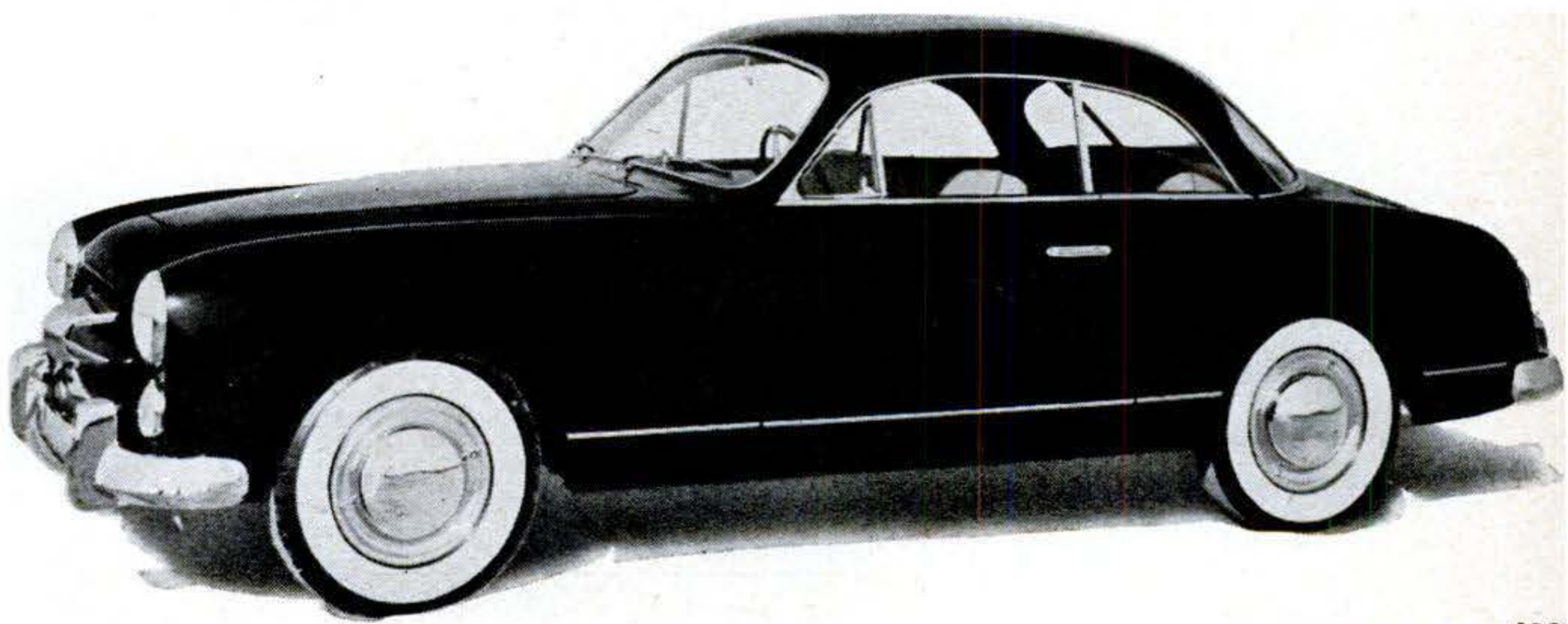
LATEST of an impressive array of military jets developed in Britain, the de Havilland 110 above recently made its initial test flight. It is the first of a new class of day and night fighters, and is built on the twin-boom principle, with sharply swept-back wings. Two Rolls-Royce Avon jet engines propel it. Speed has not been revealed, but the plane is reported to combine "very high performance" with modern navigation and combat aids.

Flying-Saucer Air Express

DROPPED without 'chutes, from planes to troops, pancake-shaped rubber containers (left) deliver five gallons of water or gasoline apiece. Even when tossed from 2,000-foot altitude in Army Quartermaster Corps trials, they did not burst or spill. They just bounced. Only one precaution is needed—taking care not to hit the GIs.

French Ford Has Italian Look

THE handsome two-door, four-passenger sedan below is the newest Ford with a French-Italian accent, the *Comete* (Comet). In a luxury-style body designed by Italy's famed Pinin Farina, it duplicates mechanical features of the French Ford Co.'s popular eight-cylinder *Vedette* (Scout). Price: $3,943.



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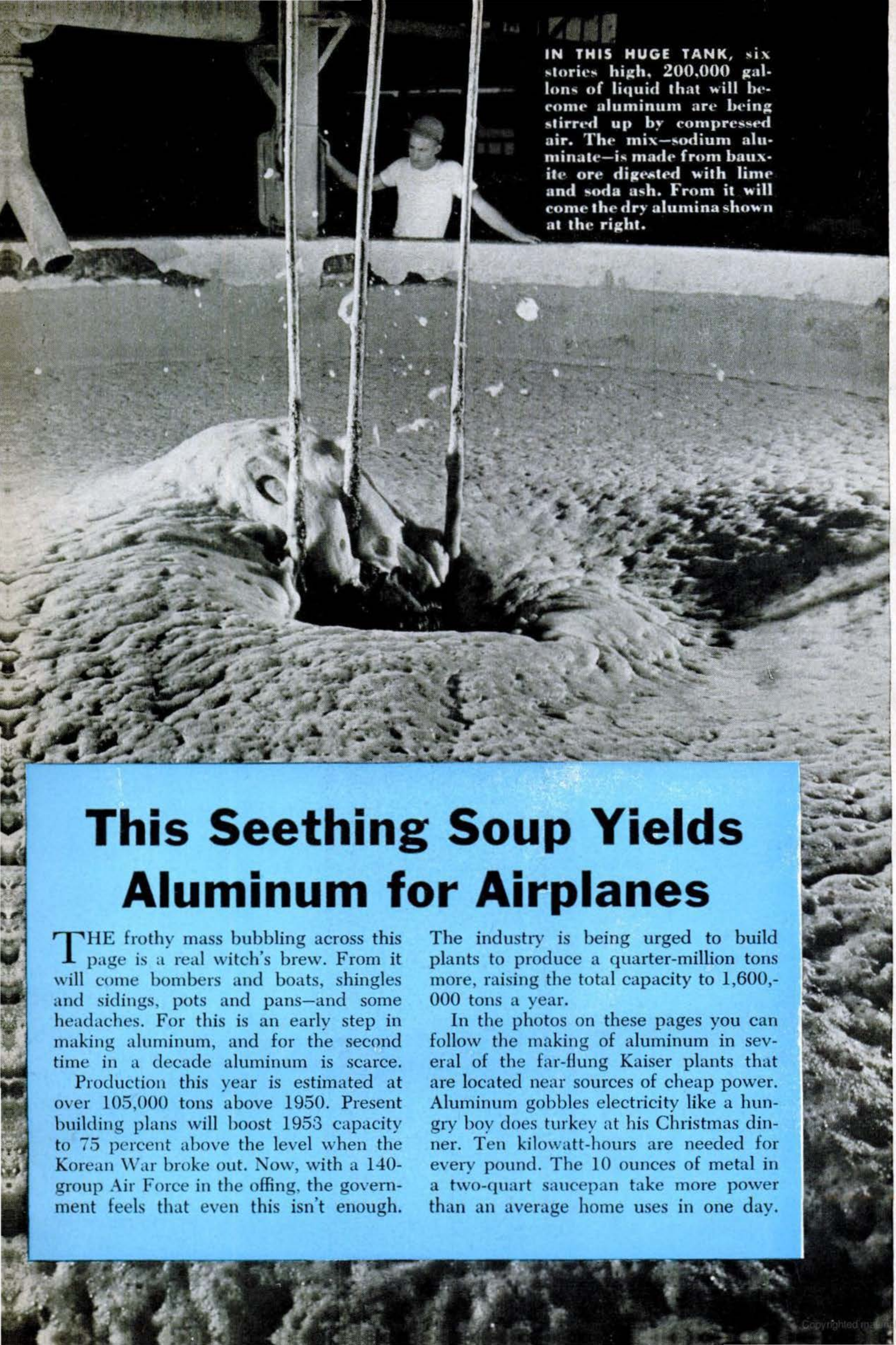

IN THIS HUGE TANK, six stories high, 200,000 gallons of liquid that will become aluminum are being stirred up by compressed air. The mix—sodium aluminate—is made from bauxite ore digested with lime and soda ash. From it will come the dry alumina shown at the right.

This Seething Soup Yields Aluminum for Airplanes

THE frothy mass bubbling across this page is a real witch's brew. From it will come bombers and boats, shingles and sidings, pots and pans—and some headaches. For this is an early step in making aluminum, and for the second time in a decade aluminum is scarce.

Production this year is estimated at over 105,000 tons above 1950. Present building plans will boost 1953 capacity to 75 percent above the level when the Korean War broke out. Now, with a 140-group Air Force in the offing, the government feels that even this isn't enough. The industry is being urged to build plants to produce a quarter-million tons more, raising the total capacity to 1,600,000 tons a year.

In the photos on these pages you can follow the making of aluminum in several of the far-flung Kaiser plants that are located near sources of cheap power. Aluminum gobbles electricity like a hungry boy does turkey at his Christmas dinner. Ten kilowatt-hours are needed for every pound. The 10 ounces of metal in a two-quart saucepan take more power than an average home uses in one day.

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DRY ALUMINA, a white powder, is shipped to plants near large suppliers of cheap power needed to convert it into aluminum. Here the alumina is being sucked by hose from a boxcar at the Kaiser mill near Tacoma, Wash. It will move on an endless belt to storage. About two pounds of alumina are needed for each pound of aluminum.

ALUMINA IS REDUCED TO METAL in great "pot lines." Each pot is an electrolytic cell where alumina and cryolite are melted together while heavy current flows through them between electrodes. The current drives oxygen from alumina, leaving molten aluminum, which sinks to bottom. In Sonderberg process (at left below), current flows between suspended carbon-paste anode and carbon-paste lining in pot. In similar Hall process (at right below), anodes are solid blocks of carbon hung on rods. Workman below periodically breaks crust to admit more alumina. *(Continued on next page)*

CRUCIBLE HOLDS MOLTEN ALUMINUM, 99.5 percent pure, that has been siphoned off from pot. Here it is being poured into an ingot mold. The cryolite remains in the pot where it is used up very slowly. But about two-thirds of a pound of carbon is consumed for every pound of metal produced. Power demands of process determine plant sites.

INGOTS ARE HOT-ROLLED in first step to make sheets. Slab is going through a 120-inch reversing mill under millions of pounds of pressure that will squeeze 13-inch ingot to three-inch thickness. Another mill will press it to one-inch thickness, 120-foot length. Final roll in five-stand continuous mill will turn out strip .1 inch thick, 1,200 feet long.

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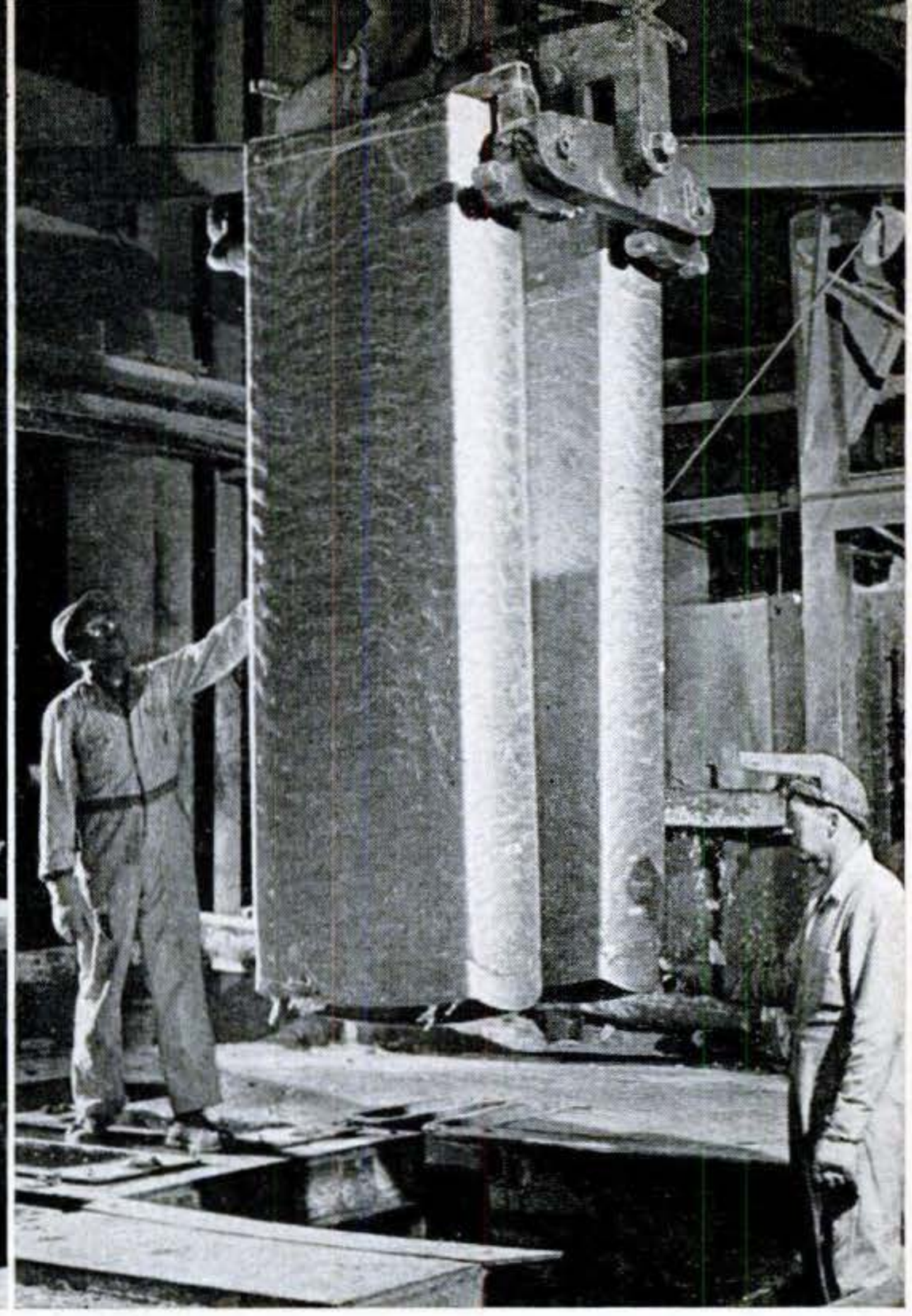
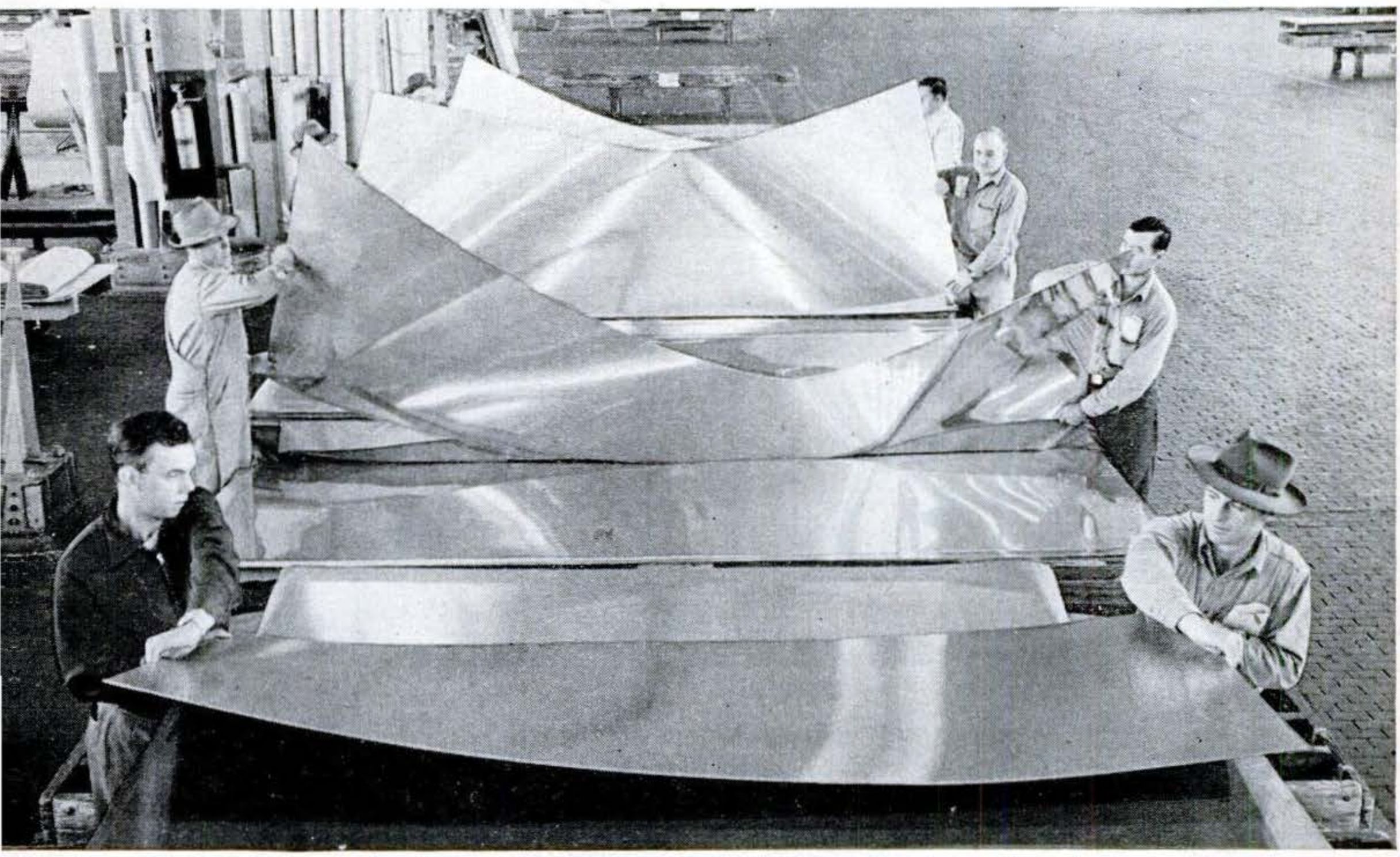
HALF-TON ALUMINUM INGOT is lifted from the mold. This is the finished product of reduction plant, ready for the fabricating plant. For many uses aluminum must be alloyed.



IN THIS GIANT INGOT at plant near Spokane, Wash., aluminum has been alloyed for strength, will now be fabricated. Surface impurities will first be "scalped" off.



FLAT SHEETS are result of additional passes through cold mills. Then comes polishing and flattening in stretching machines after sheets have been cut into shorter lengths. Above, inspectors are checking sheets carefully for flaws. By mill custom, each inspector wears a hat while his assistant remains bare-headed. END

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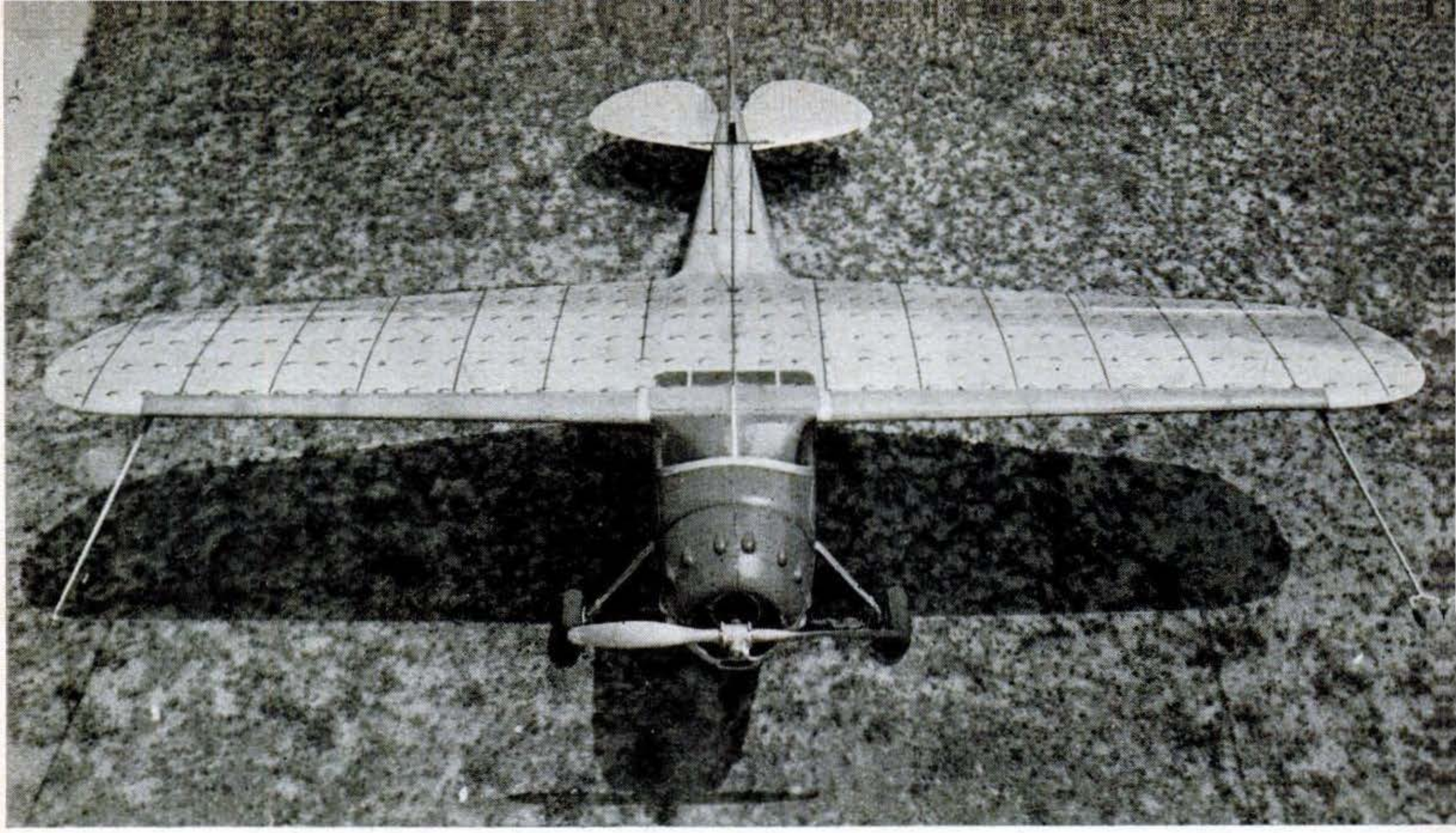

WING PUMP in cabin, driven by auto engine, sucks air from leading edges and discharges it aft through ports in fuselage.

Airplane Has Porous Wings

THOUGH porous airplane wings sound as impractical as a sieve to hold water, they may actually permit slower and safer landings. The National Advisory Committee for Aeronautics is trying out the radical idea with the craft above. Through leading edges of perforated metal, a blower sucks in air to reduce turbulence and thus increase lift. Strands of wool on the wings serve as wind vanes to study air currents, and are filmed in flight by a movie camera.

Power Tool Swabs Deck

WHILE Captain Bligh probably rotates in his grave, the Royal Navy has gone and ordered power tools to scrub the decks of its battlewagons. The mechanized swabber does the traditional seaman's chore as fast and thoroughly as seven sailors can by hand.

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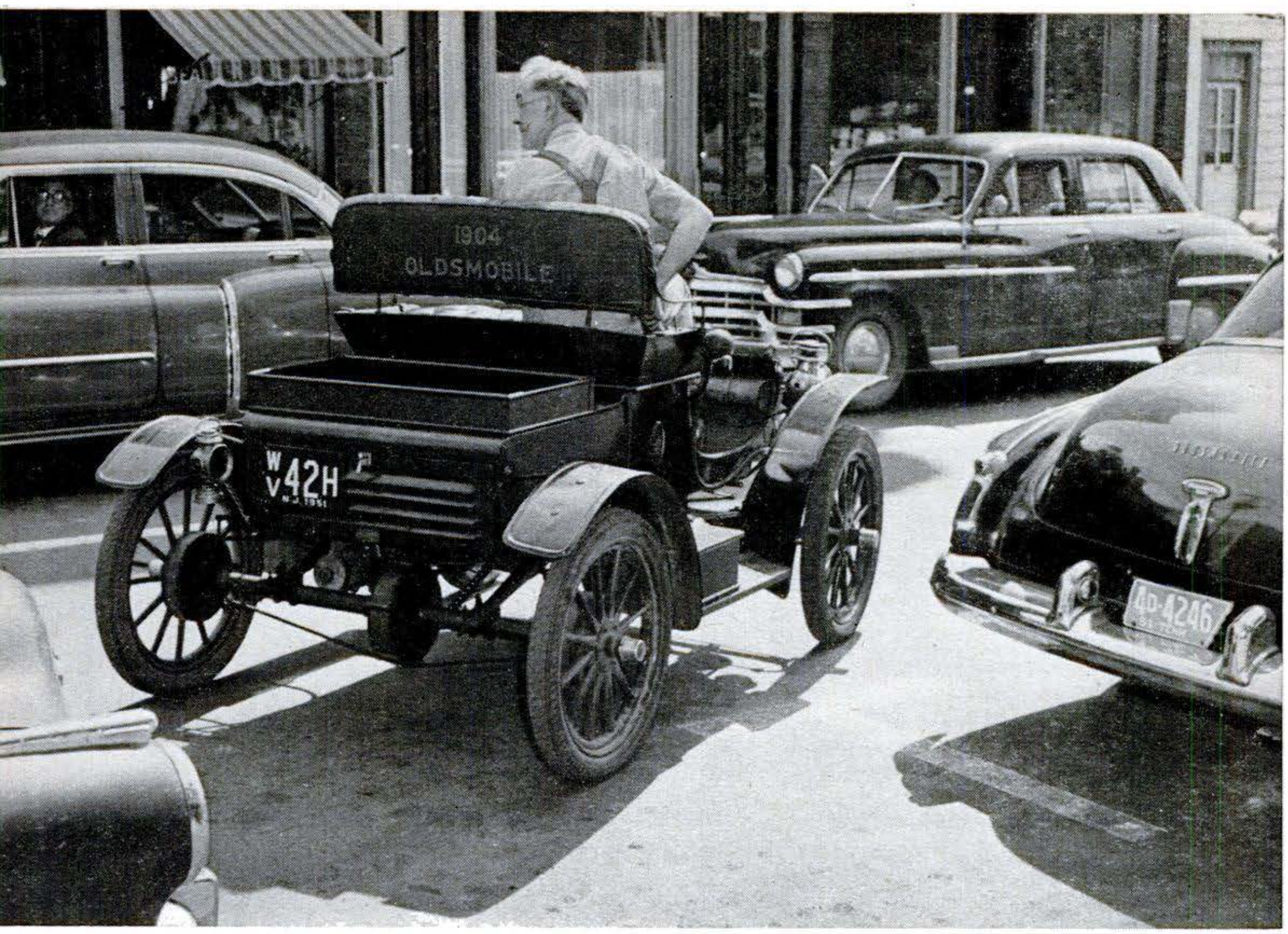

Parking his 1904 Olds behind new Olds (right), George Green actually got into this space.

From Coast to Coast in an Old, Old Olds

It's economical and easy to drive—this 1904 model that George Green bought secondhand 44 years ago.

By Gardner Soule

GEORGE C. GREEN, who for 42 years has run his own garage and machine shop at 61 York St., Lambertville, N.J., has twice driven a 1904 Oldsmobile across the U.S. and back. Had he done so when the car was new, he would have been one of the first men to cross the country by horseless carriage, which is exactly what a 1904 Olds is. But Mr. Green achieved a rarer distinction. He waited to make the trip until 1938, when few persons indeed were crossing the country in a 1904 Olds.

Mr. Green liked the trip so well, and the car performed so well, that he made the second coast-to-coast jaunt in the Olds in 1946. Meanwhile, he had kept the Olds traveling from Lambertville to New England, to the Midwest, and to the South.

He has driven the Olds, altogether, about 100,000 miles; more, he believes, than any other man has ever driven a single-cylinder car. He bought the Olds as a used car in

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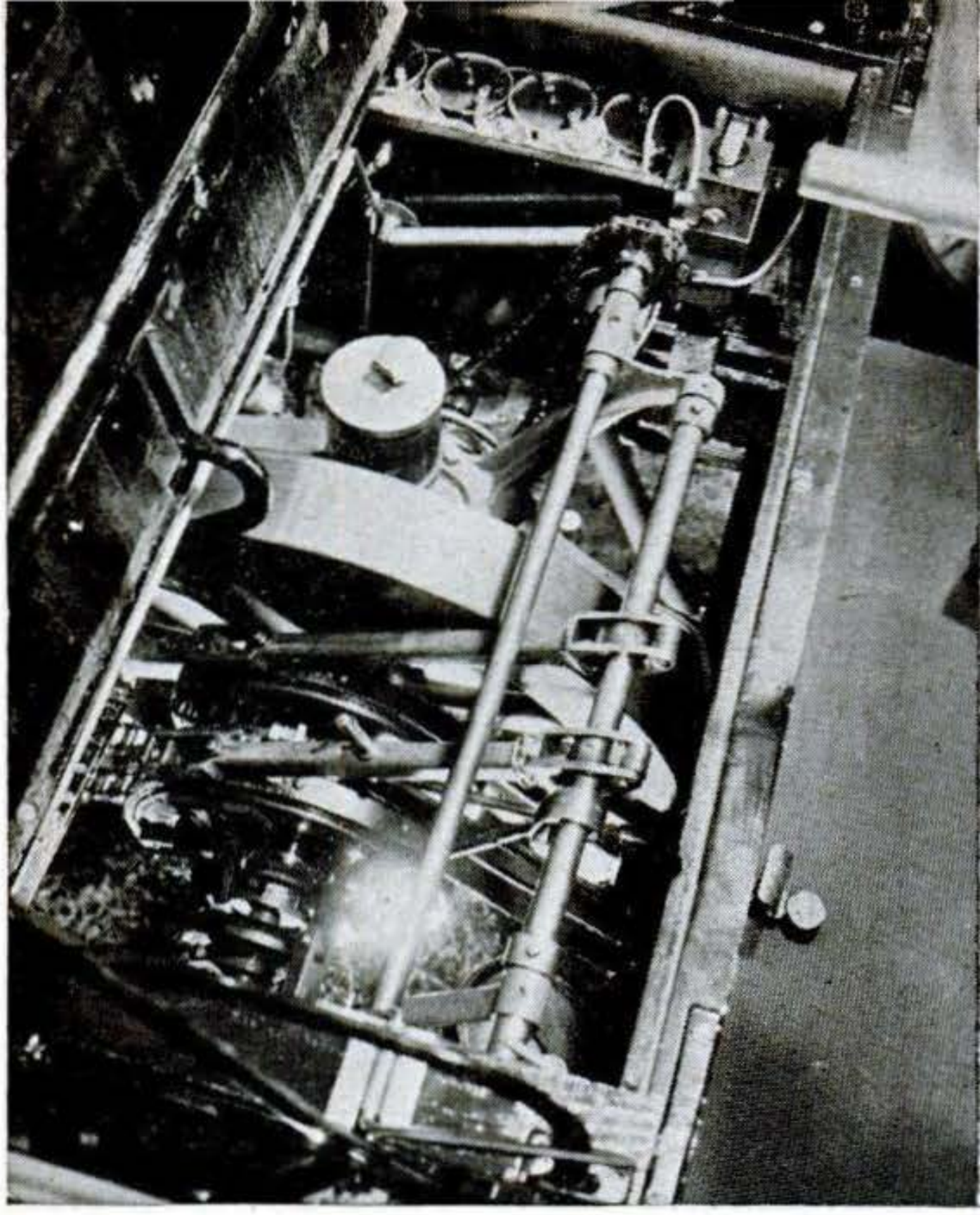
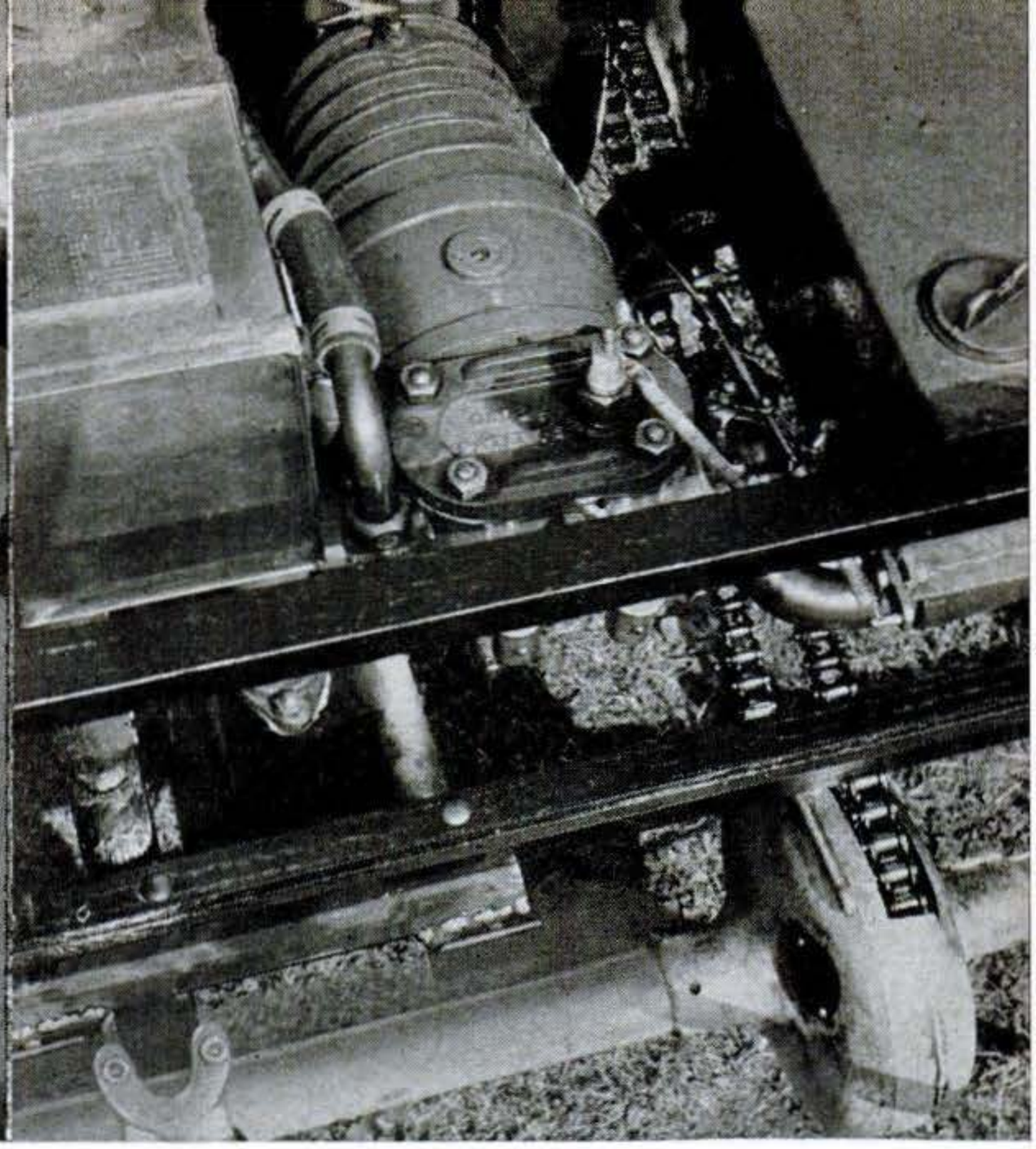
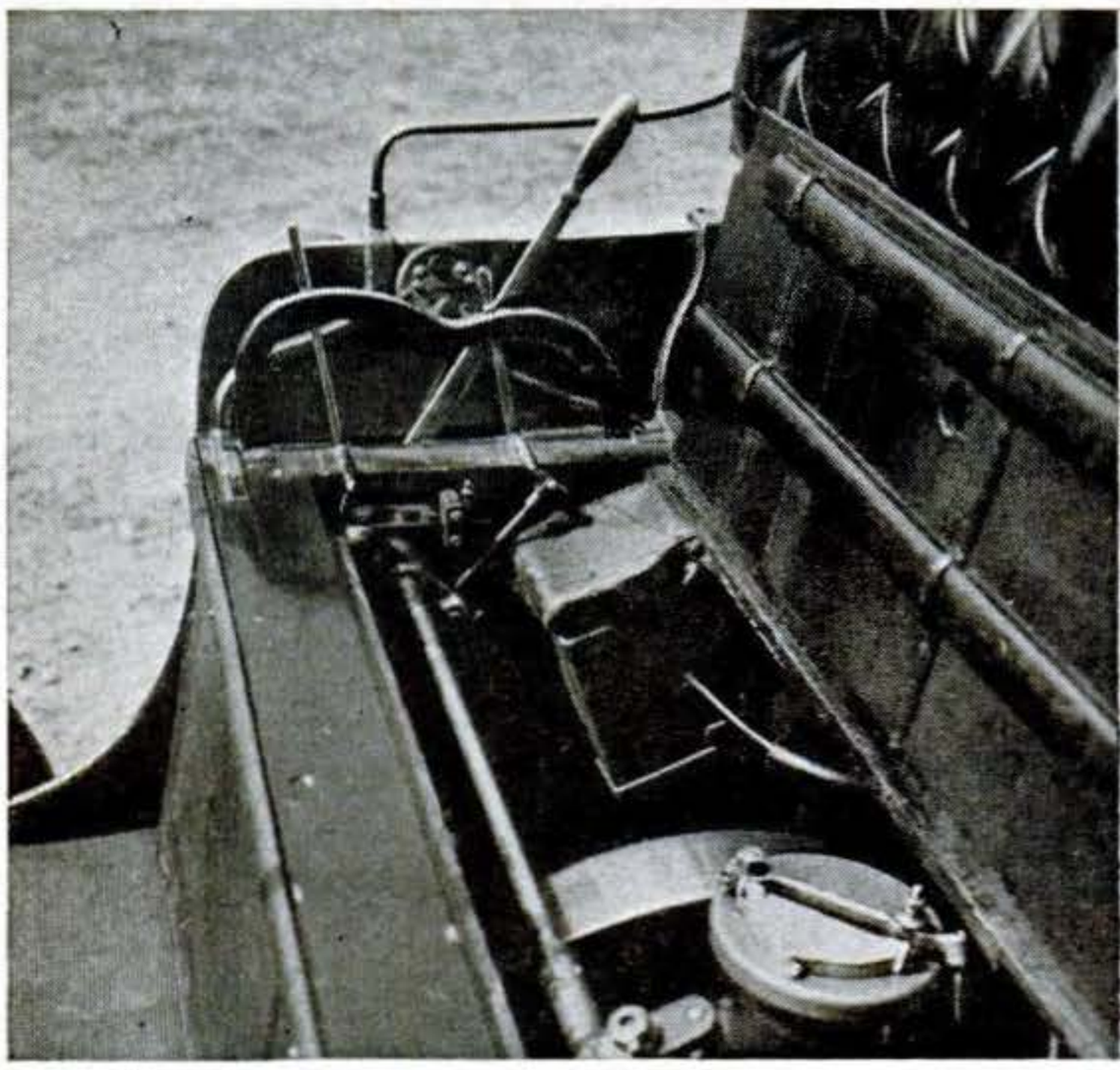


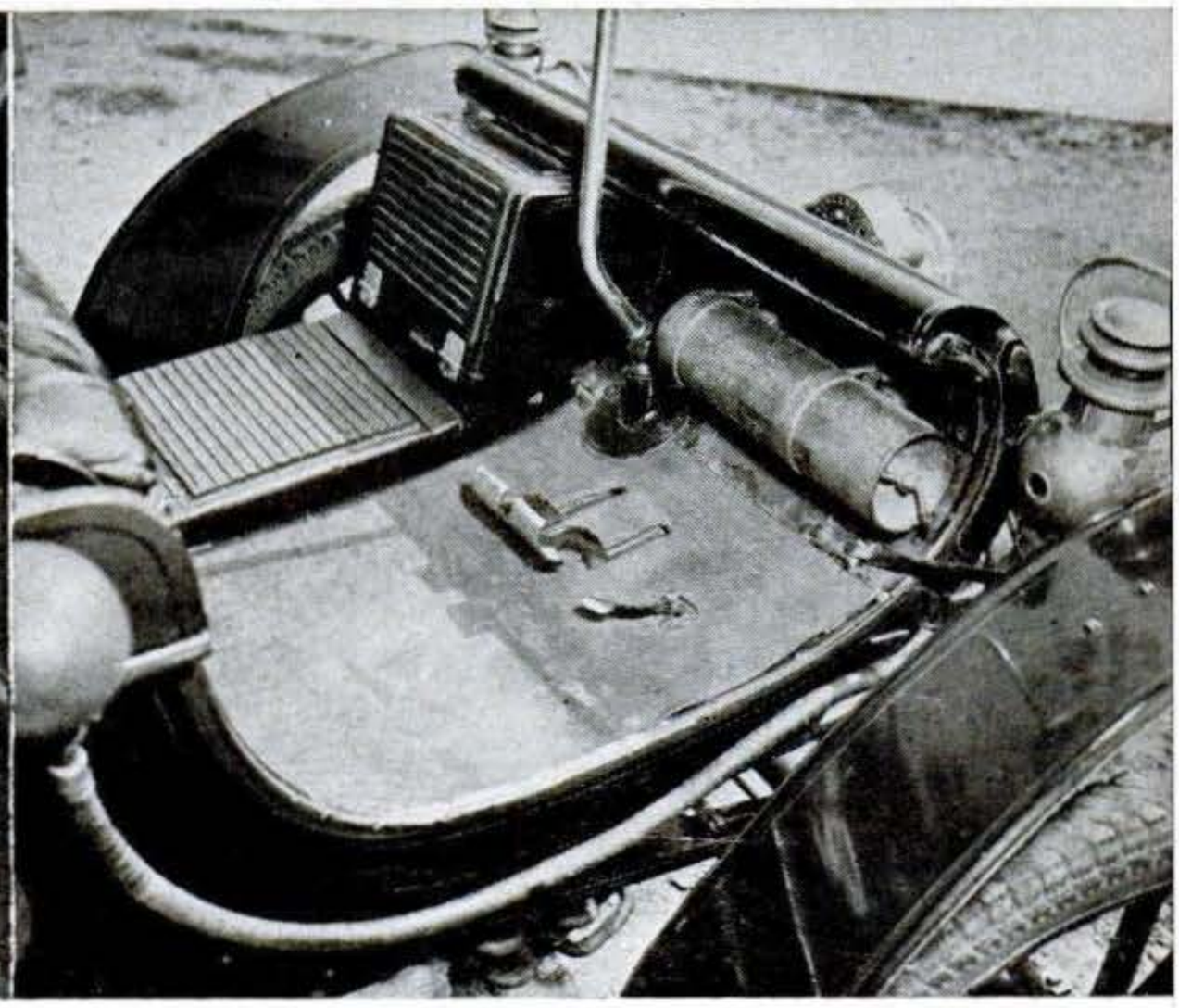
MECHANISM OF ANCIENT OLDS is under two-passenger seat. Eight dry cells at top are battery. Flywheel is in center, drive chain at bottom. Transmission is double planetary.



SINGLE CYLINDER is in rear of car. Spark plug is in center of picture. Beside cylinder are flywheel and drive chain. Gas tank is at right, water tank at left.



UPTURNED SEAT again shows flywheel near foreground. Tall lever is gearshift. There are two speeds forward, one reverse. Ignition switch is on round panel by gearshift.



CURVED DASH, like that of a sleigh, identified 1901 to 1905 Oldsmobiles. Only pedals are accelerator (right), and two brake pedals, one of which locks brakes for parking.

1907, has owned it ever since, and has licensed and used it every year except for two during World War I. He has, therefore, probably owned one car longer than any other man.

All this has been possible because Mr. Green is undoubtedly the man most able to keep a 1904 Olds running. He had a reputation—in 1903—of being able to repair autos: Stearnses, Ramblers, Mitchells, Columbias, Thomas Flyers and Oldsmobiles. He has been repairing Olds cars ever since and today is, so far as he knows, the only antique-automobile specialist on Oldsmobiles.

His garage and machine shop makes parts

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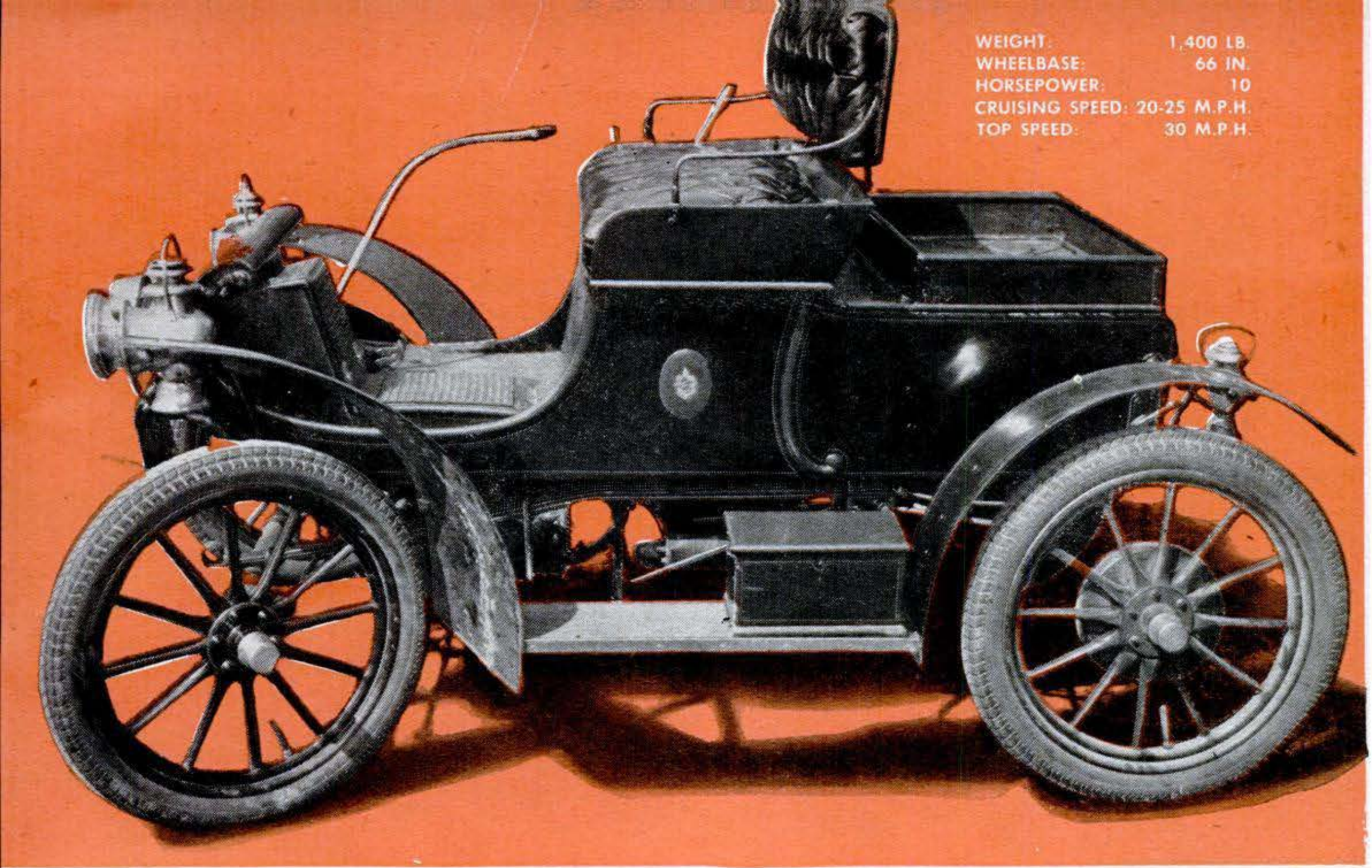
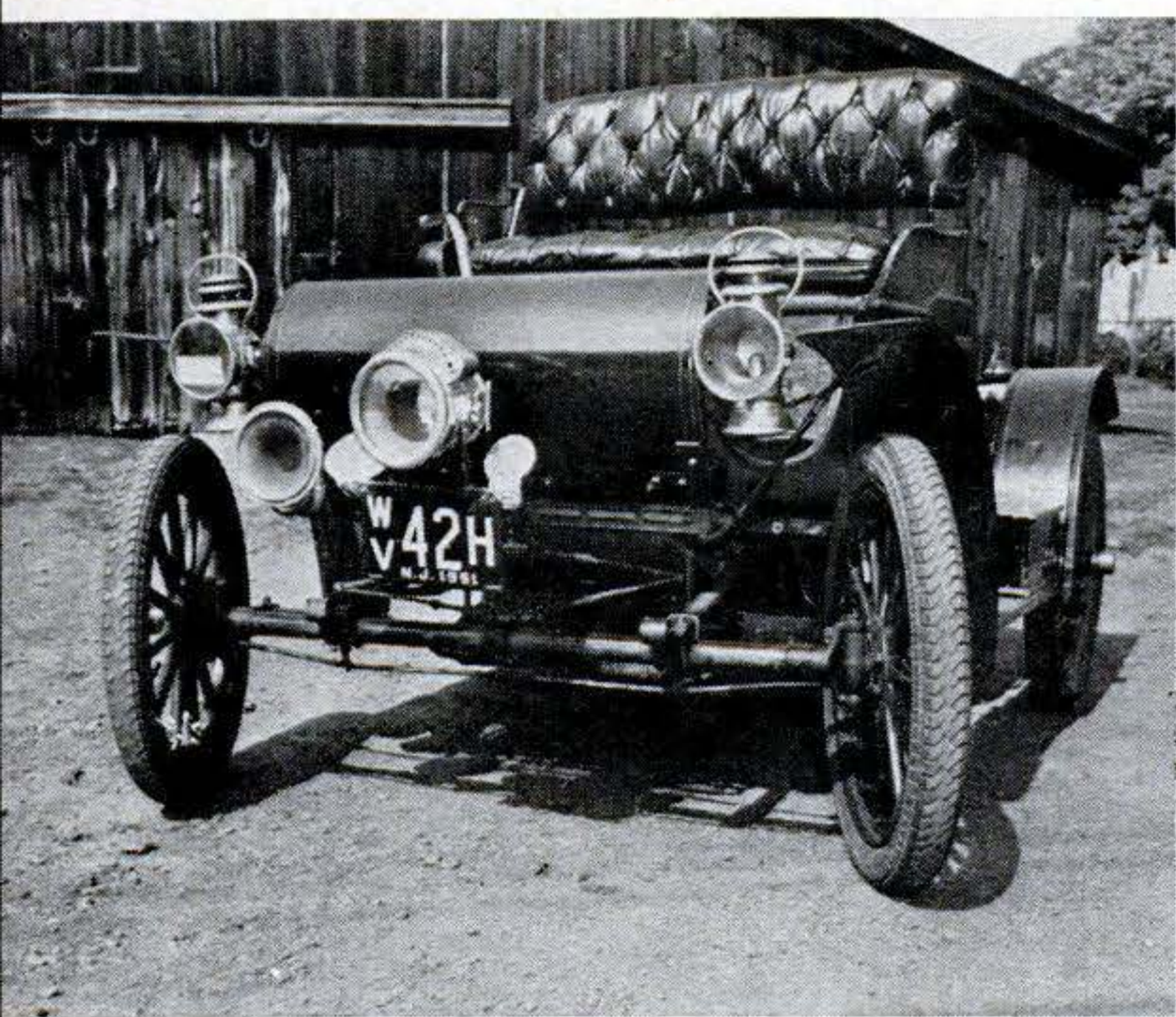
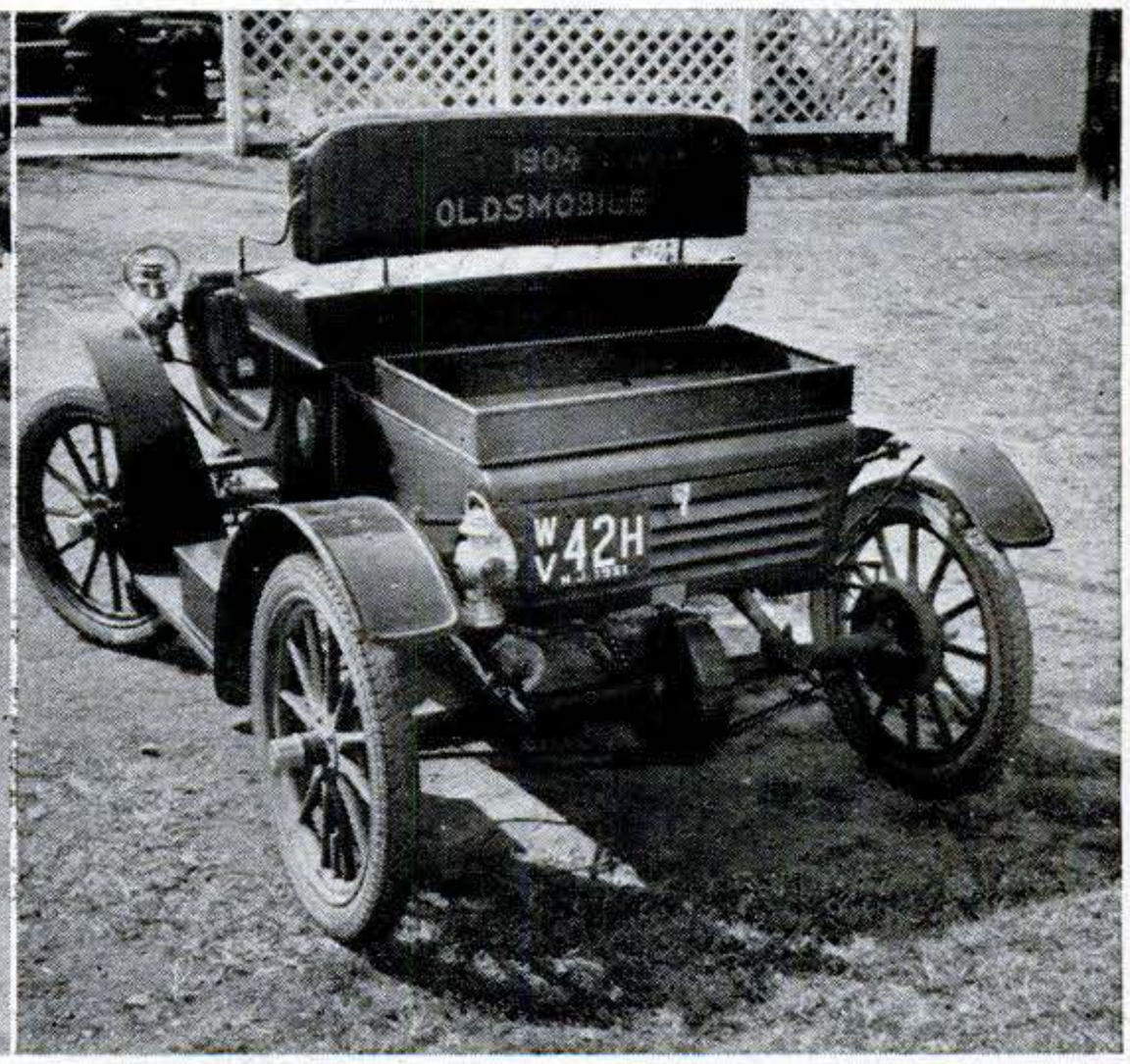


SIDE VIEW shows that 1904 Olds is real horseless carriage. It cost Mr. Green $165. Tires are 28x3, take 40-50 lb. air pressure. Fenders are called mudguards.



FRONT VIEW shows kerosene headlights (at sides), extra acetylene lamp (center) put on car by Mr. Green in 1907. Leather on seat has been replaced once in car's life.



REAR VIEW shows tail light and platform built over cylinder and gas and water tanks. Some 1904 Oldsmobiles had another seat for two, facing rearward, where platform is.

for factory machines as its main line. But in the shop two or three aged Olds are restored each year. Restoration amounts to rebuilding. "You can't do 'em any faster," Mr. Green says. He often has to make the parts —sprockets, pistons, gears, fenders and springs. Altogether, he has restored about a dozen.

The first car Olds built, a three-wheeled steam carriage, was completed in 1886. By 1901, Olds had switched to gasoline and his four-wheel, curved-dash runabouts were manufactured through 1905, and were immortalized in 1905 in a song, "In My Merry Oldsmobile."

These runabouts were the first cars ever

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CRANK IS AT RIGHT-HAND SIDE of seat. It may be turned by driver from seat, as shown above. In background is entrance to Mr. Green's machine shop in Lambertville, N. J.

MR. GREEN RESTORES two or three ancient Oldsmobiles a year. Able to reach almost any part of chassis while standing, he does not have to crawl around underneath the car.

produced on assembly lines, and 5,000 were made in 1904 (and sold for $650 each), while other cars were built by dozens or hundreds. Being small, they have been stored over the years in the corners of barns. The mass production and easy storage are the reasons that the 1904 Olds is fairly common today among the antique-automobile set.

Mr. Green would rather drive the Olds than a modern car. "As long as the weather is fit" he drives it constantly. "It is easy to park," he explained. "You can see where you're going. It's the only car I have that knows the road. The others—you have to *steer* them. And in nice weather there's a certain satisfaction."

Not an All-Weather Car

In bad weather, the car can go right along, but the passengers sometimes cannot. How would you like to be perched on that seat in a high wind, a freezing rain or a snowstorm? A top that Mr. Green used on trips has proved impractical and he has ceased to use it. So when the weather turns bad, Mr. Green heads the car into a barn or garage and waits for the weather to improve.

As you chug along with Mr. Green, you realize that something has gone out of automobiling since *Munsey's Magazine,* in 1904, about the time Mr. Green's Olds was new, printed the words:

"The cubic feet of fresh air that are literally forced into one while automobiling rehabilitate worn-out nerves and drive out worry, insomnia, and indigestion."

There is a continual throbbing. "You always get the heartbeat of that one lung," says Mr. Green. He seeks to drive on concrete roads, either side roads with no traffic or parkways that are very wide. Two-lane roads with heavy traffic give him trouble. The Pennsylvania Turnpike is a favorite, because he can make such good time on it. Last time he traveled the turnpike, from end to end, he averaged 22 miles an hour. Stopped for lunch, too. Twenty to 25 m.p.h. is cruising speed. The Olds can make 30—all out, that is.

Never Towed by a Horse

In his first years of driving the Olds, Mr. Green frightened many a horse. But the Olds never was towed by a horse. It was towed once, though. The bolt in the connecting rod broke about 40 years ago, when he was three miles out of Lambertville, and

[Continued on page 258]

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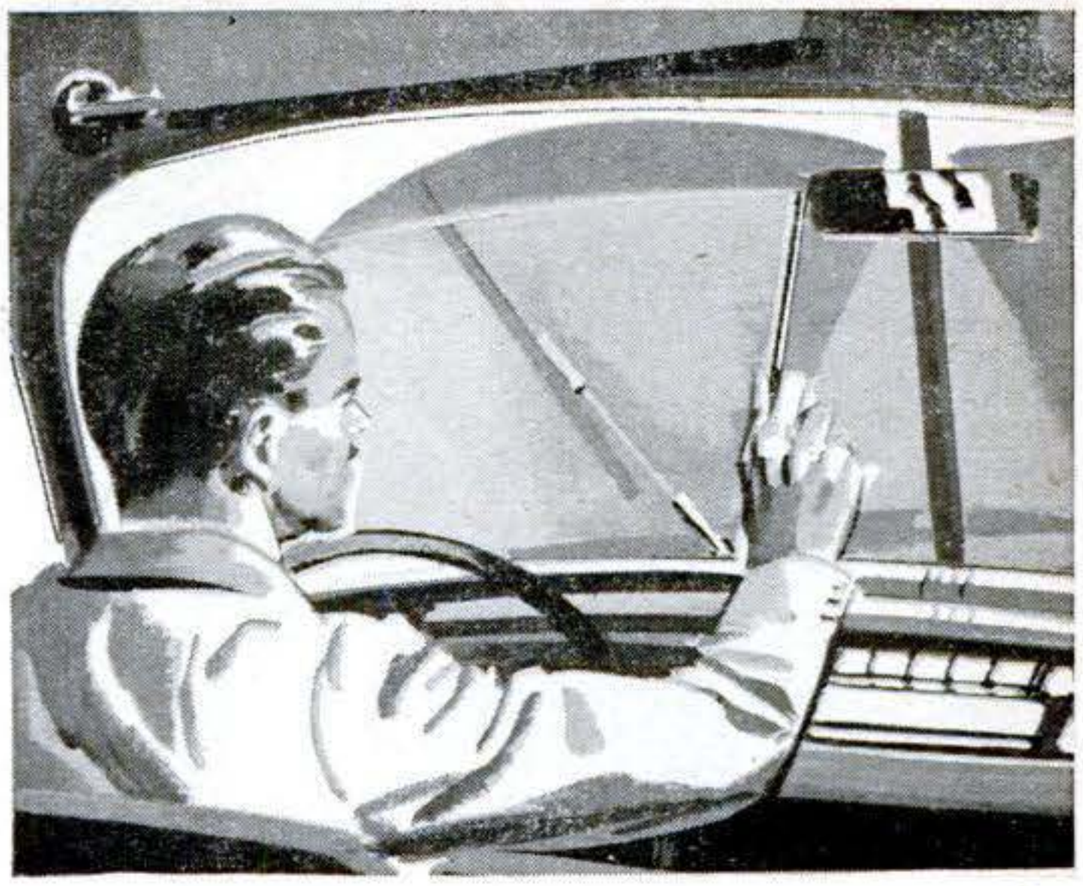
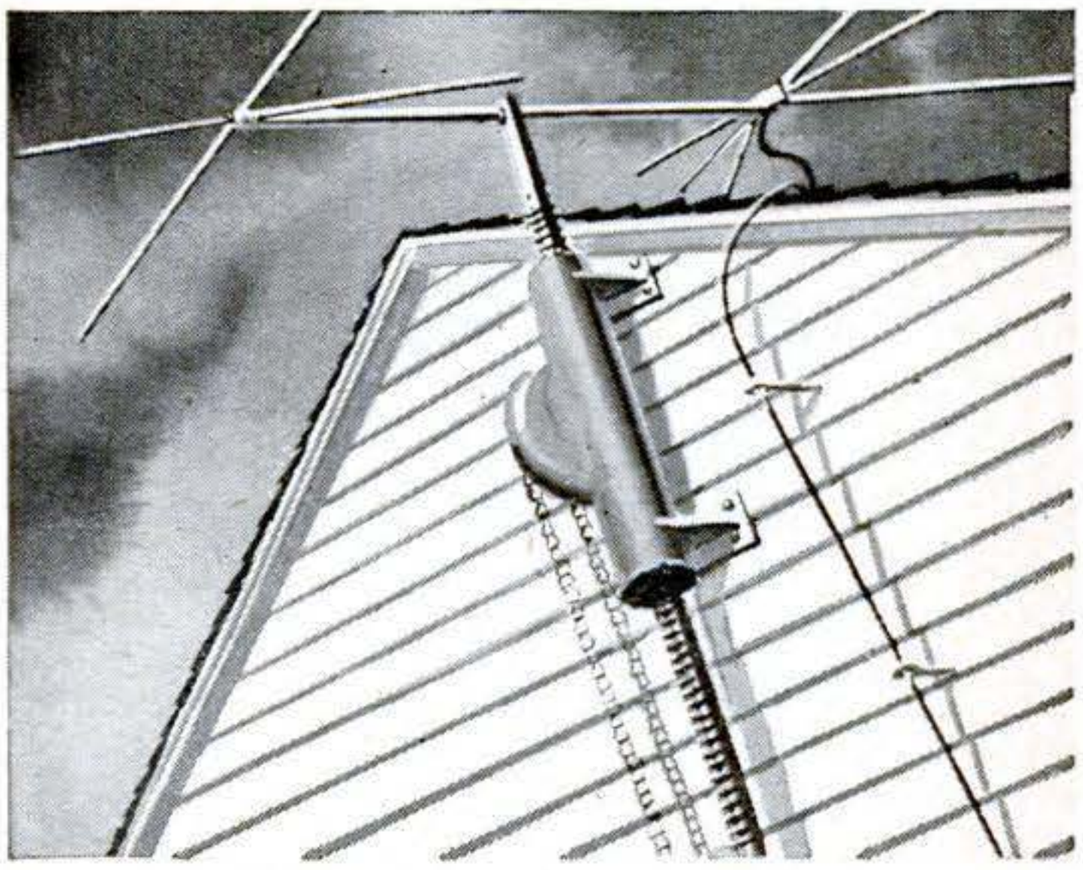
I'd like to see them make...

Everyone has his own pet idea of some gadget he would like to see in general use. What is YOURS? *Popular Science* will pay $5.00 for each one published. Use government postcards only. Contributions cannot be acknowledged or returned.

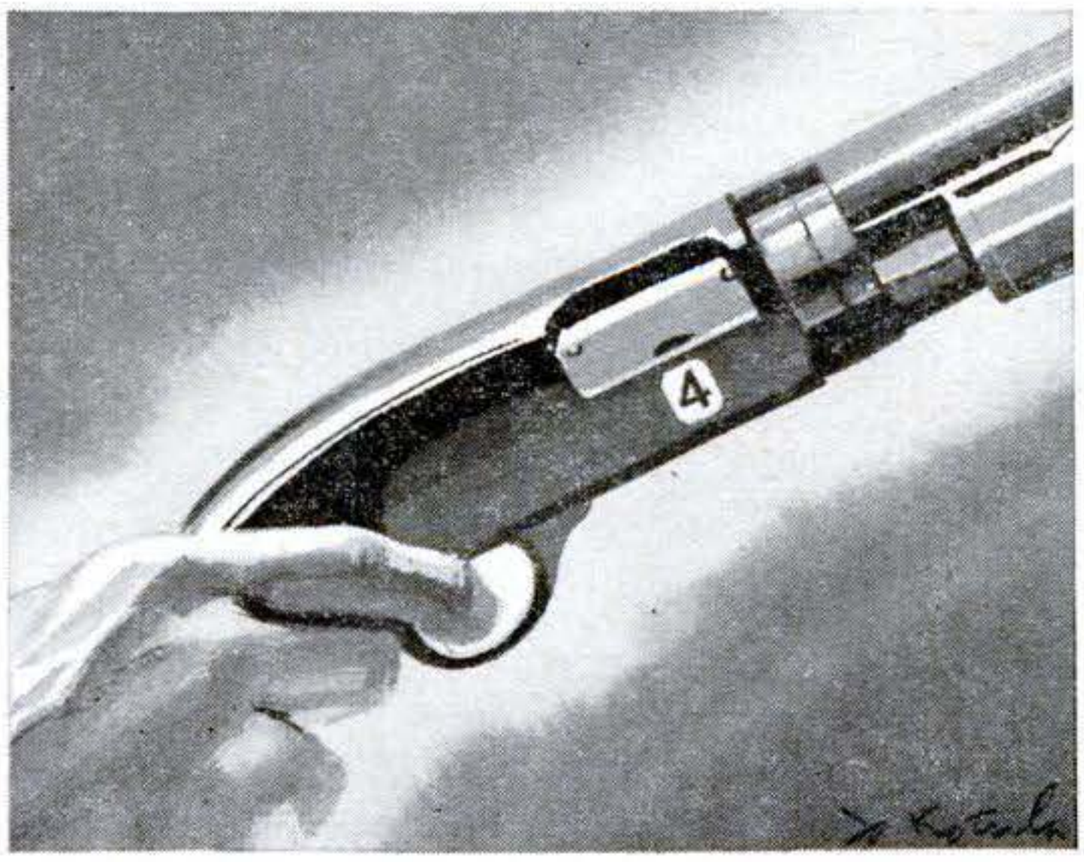


AN EXTRA SET OF WINDSHIELD WIPERS on the inside of the car. Fog that often forms there and obscures the driver's vision could be wiped off. Wipers would be operated manually.—*Mrs. C. A. Mallory, Conneaut, Ohio.*

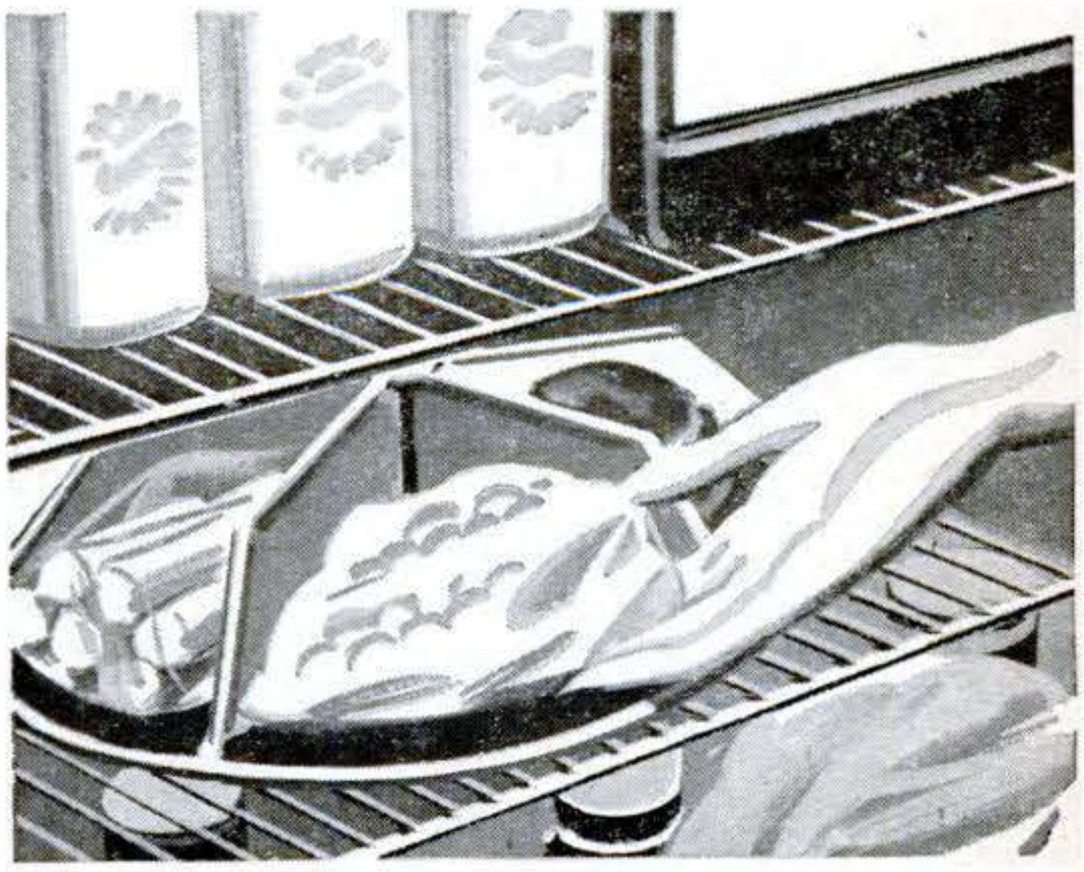
A VACUUM NURSING BOTTLE so that the baby's milk could be kept warm while he is outside in the carriage. It would also be very helpful when traveling.—*Mrs. G. Rowland, Hartford, Conn.*



A RETRACTABLE TELEVISION MAST that could be lowered during a storm to eliminate damage and expensive repairs. It would be operated from a window by means of a pulley.—*Jim Stegenga, Grand Rapids, Mich.*



A COUNTING DEVICE ON AN AUTOMATIC RIFLE. It would register the number of shots fired, so that you would know how many rounds were left in the magazine.—*Frank Vana, Baltimore.*



A "LAZY SUSAN" REVOLVING SHELF IN REFRIGERATORS. For those leftovers and other small items that always disappear into the most inaccessible corners at the backs of the shelves. —*Mrs. E. Miller, Lansing, Mich.*

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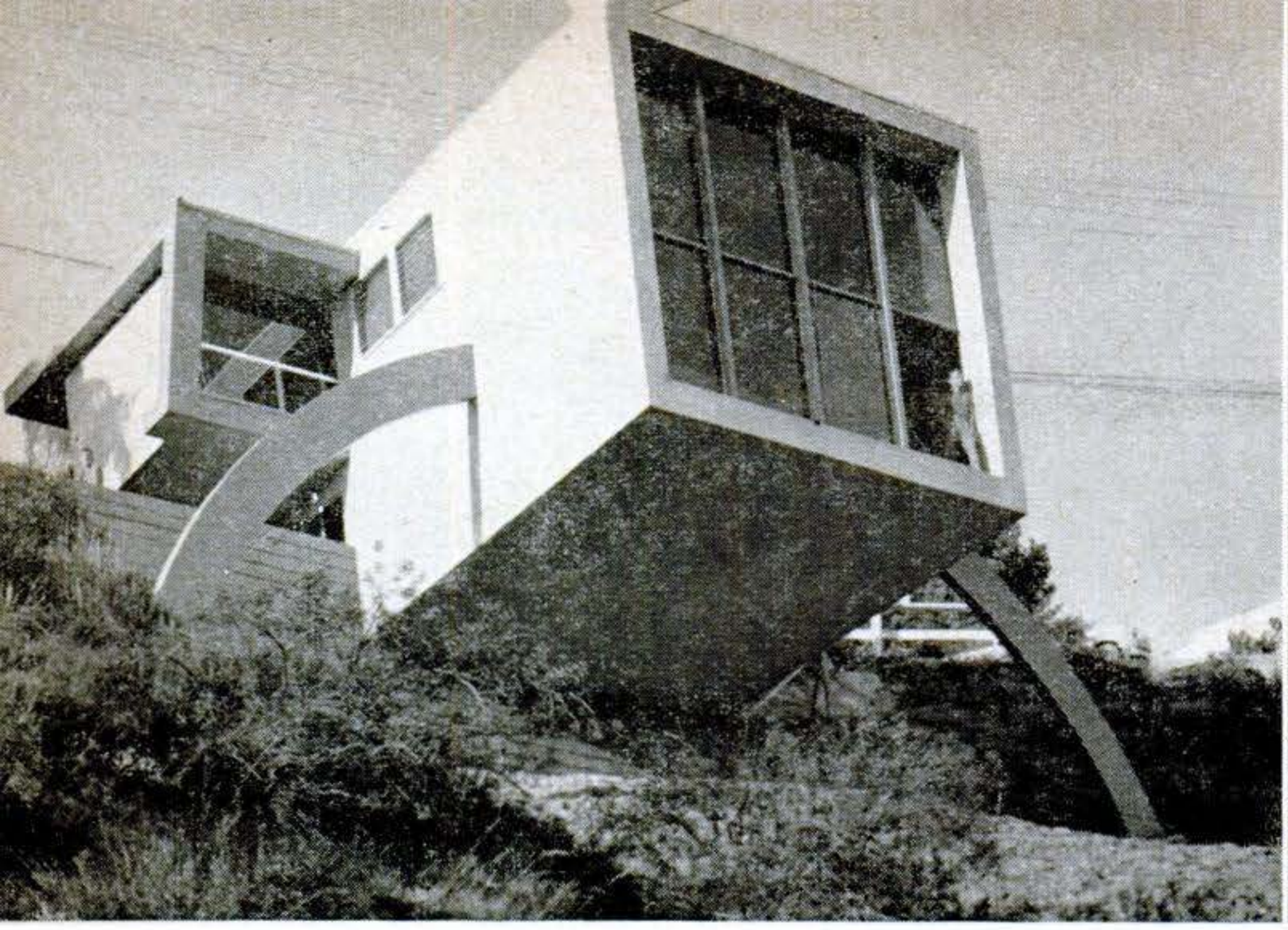
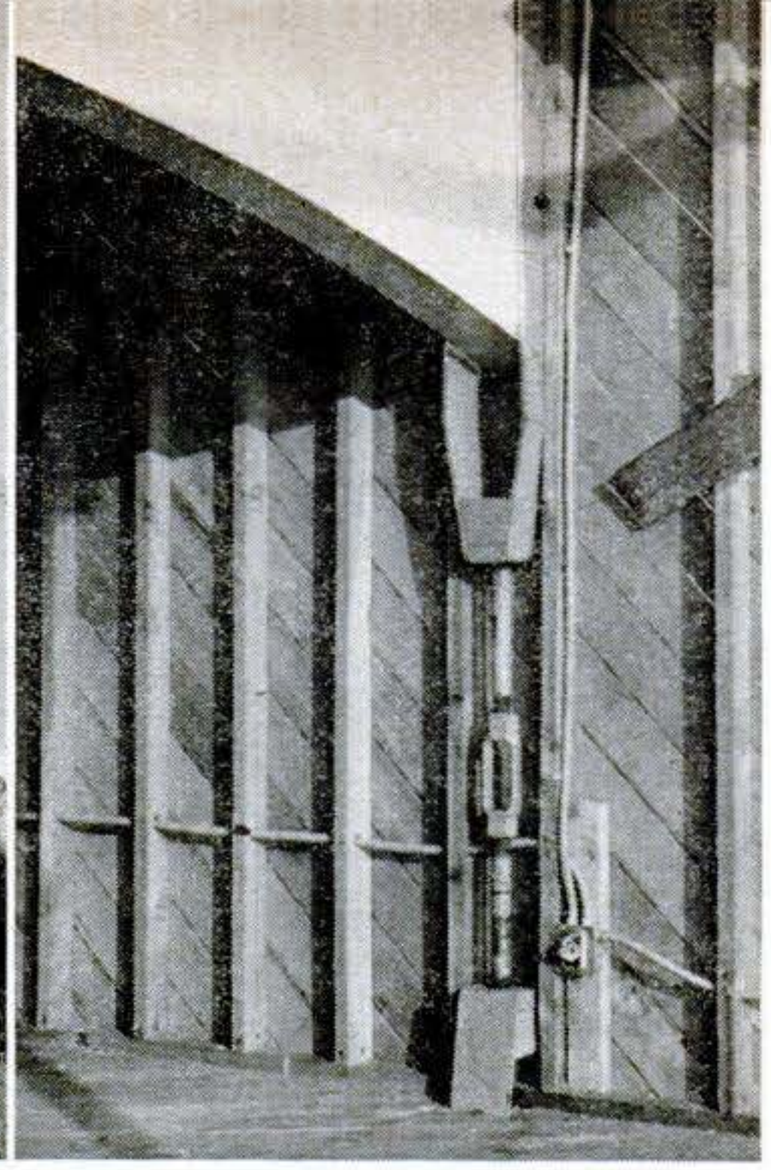


AN ARCH WITH 60-FOOT SPAN runs through the center of the suspended section of this house and is part of interior construction.

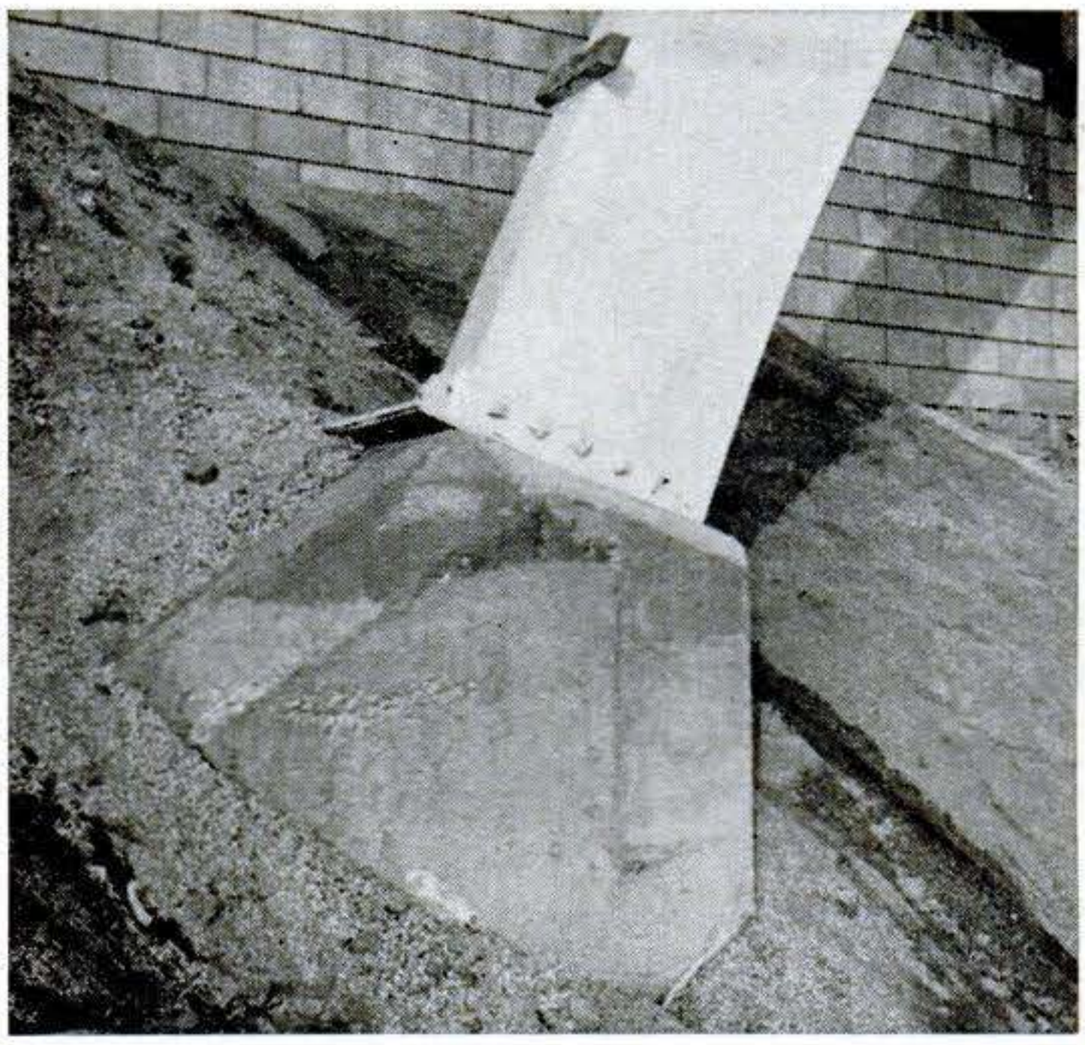


ARCH SUPPORTS HOUSE through steel-strap hangers, tie rods and turnbuckles. These were later concealed inside finished wall.

Hillside House Hangs in Space

BY RUNNING a big arch right through the house, two young designer-contractors were able to build a home on a clifflike lot offering a magnificent view from the Hollywood hills, and yet avoid expensive foundation work. Inside, the arch forms the railing for a dining balcony that projects into the two-story living room.

The arch, made of laminated Douglas fir that was electronically glued, is the type widely used to support the roofs of airplane hangars and warehouses. Only the living-room wing hangs on the arch. The rest of the house, designed by L. C. Guthrie, Jr. and R. O. Spencer, sits on a foundation.



ARCH IS ANCHORED to concrete footings. Made up in two sections for easy transportation, it was spliced together at site. A 70-foot crane was used to set it in place.

Toy Copies Giant Earth Mover

THIS new toy for budding highway engineers is a working model of a life-size earth scraper and hauler. Controls open two jaws in the bottom of the unit to scoop up sand or dirt, close them, and raise and open them again to dump the load after it is carried away. A friction-operated ram controls the opening and raising operations, and a thumb release closes the scraper jaws. Scraping depth is adjustable. The Charles William Doepke Mfg. Co., Rossmoyne, Ohio, makes the toy, which has heavy-duty rubber tires.

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What Happens When You Mail a Letter

By Herbert O. Johansen

1 OUR LETTER is dropped in a mailbox at 122nd St. and Pleasant Ave., New York City, at 11:45 A.M. to start its cross-country air-mail trip to San Fernando, Calif.

With the Christmas rush on, the complex network of men and machines that speeds the mails is working in high gear.

WHEN you drop a letter in a mailbox and hear the slot lid click, you probably give the lid a couple of extra flips for good measure. In return for that effort, plus licking the stamp, you take it for granted that your message of love, business, sorrow, cheer or complaint will be delivered to the right person at the right place in the shortest possible time.

And it almost certainly will be—along with the other 127,677,738 letters that are mailed in the United States on an average *day*—enough letters, if their envelopes were

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laid end-to-end, to reach from New York to Shanghai.

For the inside story of the intricate machinery that makes this possible—to be told by following one letter through its adventures in the U. S. mails—a PS reporter and photographer called first on New York City Postmaster Albert Goldman in the imposing building that has become famous for the quotation across its facade:

Neither snow nor rain nor heat nor gloom of night stays these couriers from the swift completion of their appointed rounds.

Mr. Goldman explained that this quotation from Herodotus was a tribute to mounted postal couriers used by the Persians during a war with the Greeks in 500 B.C.

Post Office Big Business Now

With that historical note taken care of, we learned a few facts about the modern postal system here:

- It sells about 22 billion stamps a year for more than $900,000,000.
- It employs 500,000 men and women, including 85,188 regular carriers and 32,433 RFD route men. (On an average, a carrier walks from nine to 20 miles a day, wears out a pair of shoes every three months.)
- It has 41,193 post offices of all types throughout the country.

Now, with the blessings of the Post Office Department, we were ready to mail our guinea-pig letter.

We labeled it air mail to mark the 40th anniversary of the country's first air-mail flight—a five-mile hop between Garden City and Mineola, N.Y., on Sept. 23, 1911.

Letter Rides Pneumatic Tube First

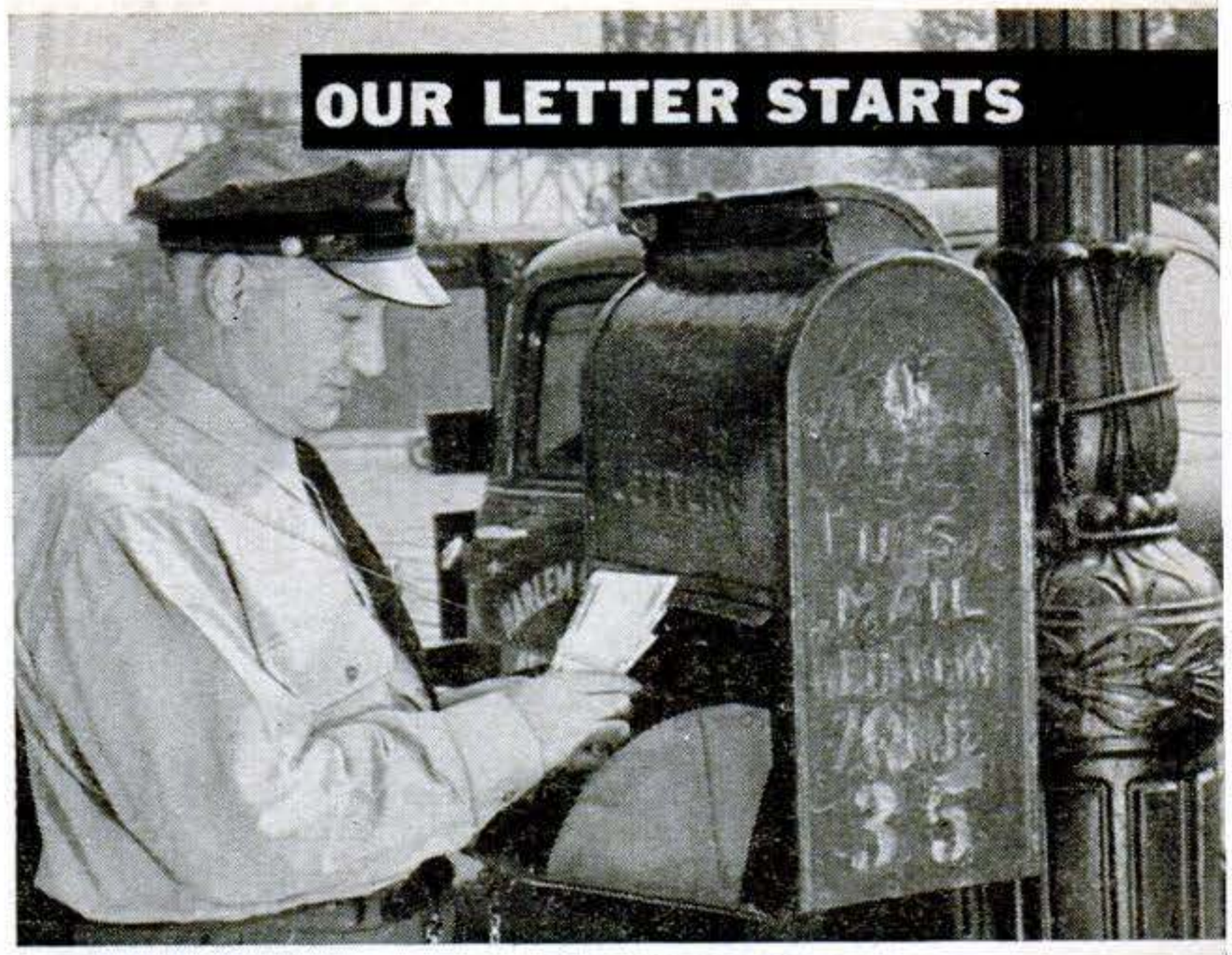
We dropped it in a box near Manhattan's Triborough station to give it a good send-off. It could start through the only intra-city pneumatic-tube dispatch system used by the post office.

In operation since 1897, the tube system is 27 miles long, forming a loop that connects 21 stations. Into it go about 95,000 projectile-like carrier cylinders a day, speeding some 5,000,000 pieces of mail to their destinations at 30 miles an hour.

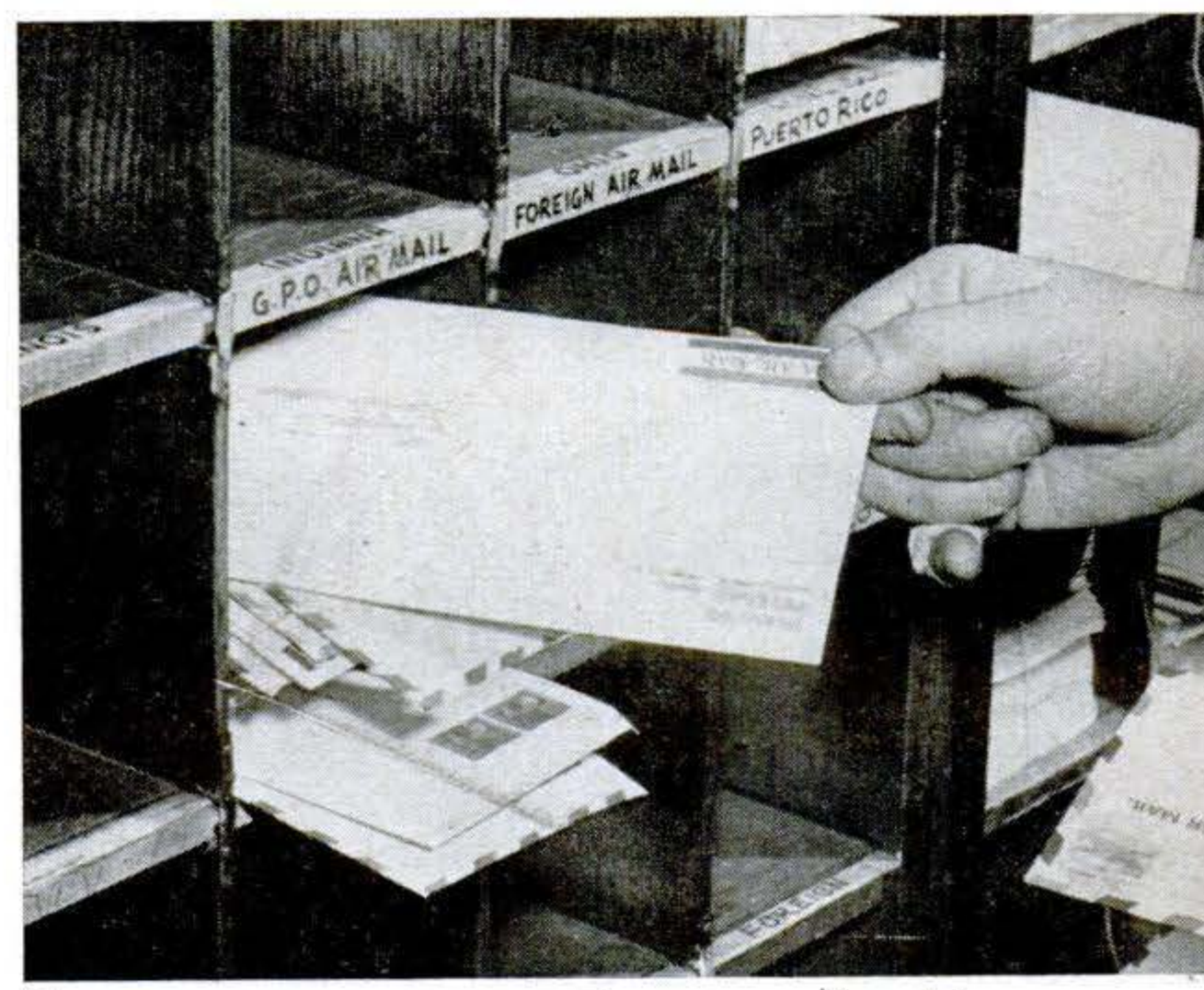
We addressed our letter to Tom Carrell, an automobile dealer in San Fernando, Calif., so we could show you the helicopter-delivery system operating from Los Angeles. Chicago is now the only other city having 'copter mail service, but it undoubtedly will be extended elsewhere when more experience has been gained and helicopters can be released from war service. Their use often saves a full day in the delivery of a letter—two days in case of a holiday or over week ends.

We could, of course, have addressed our letter so that it would have gone by other means of transportation used by the post office: train, boat, motor launch, bus, horseback, and even ski or dog sled.

But whatever the means of transportation, the post office asks only that a letter be addressed so that it can be delivered. Although this is sometimes a challenge, there



2 BOX IS "TAPPED" at 12:45 P.M. by postman No. 1,854. On one round he will collect from 27 street boxes, pick up around 1,000 letters.



5 LETTERS ARE "BOXED UP" at separation bin. Air-mail letters are "tied out" or bundled separately with a "facing-up" slip giving next destination, here GPO (General Post Office).

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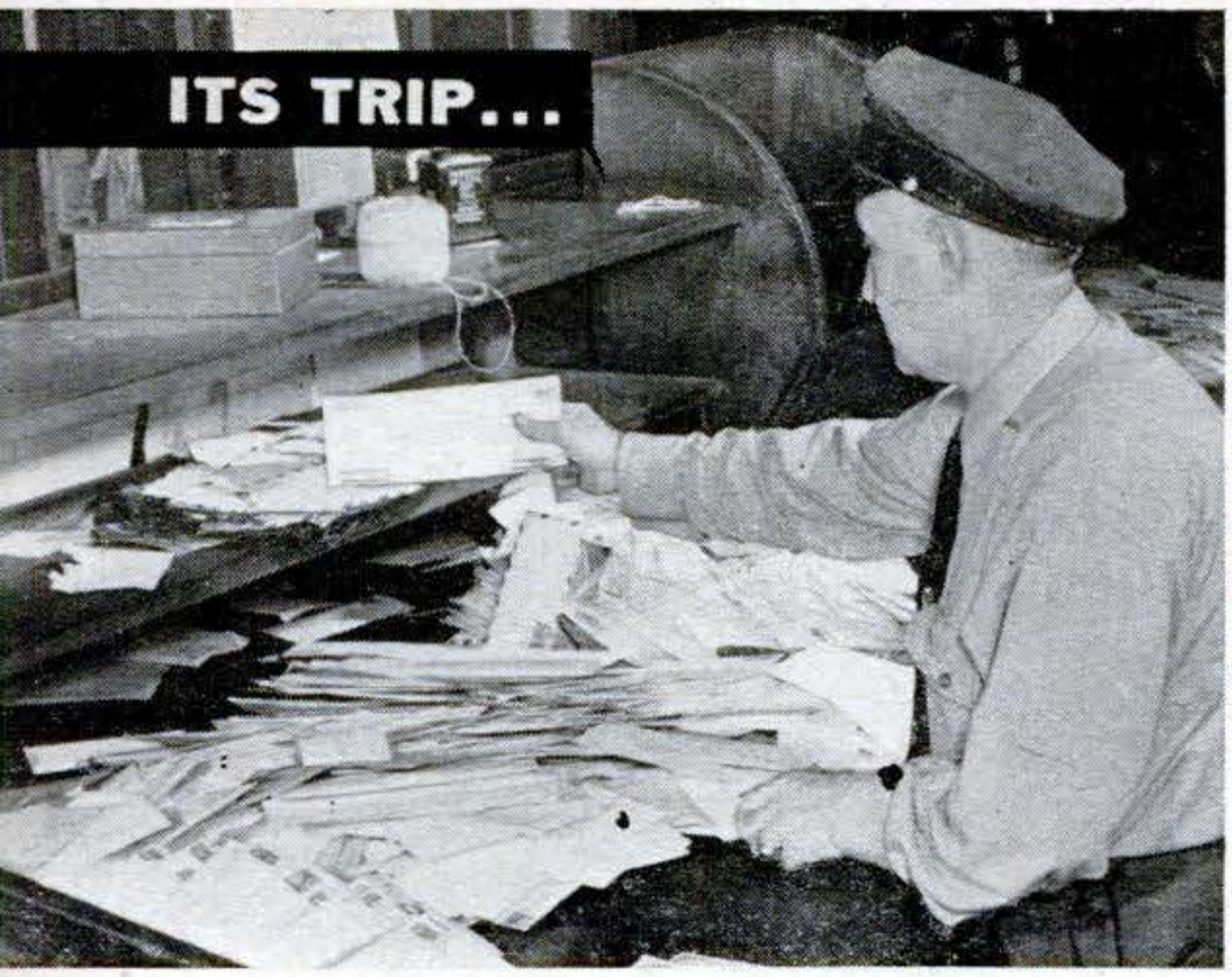
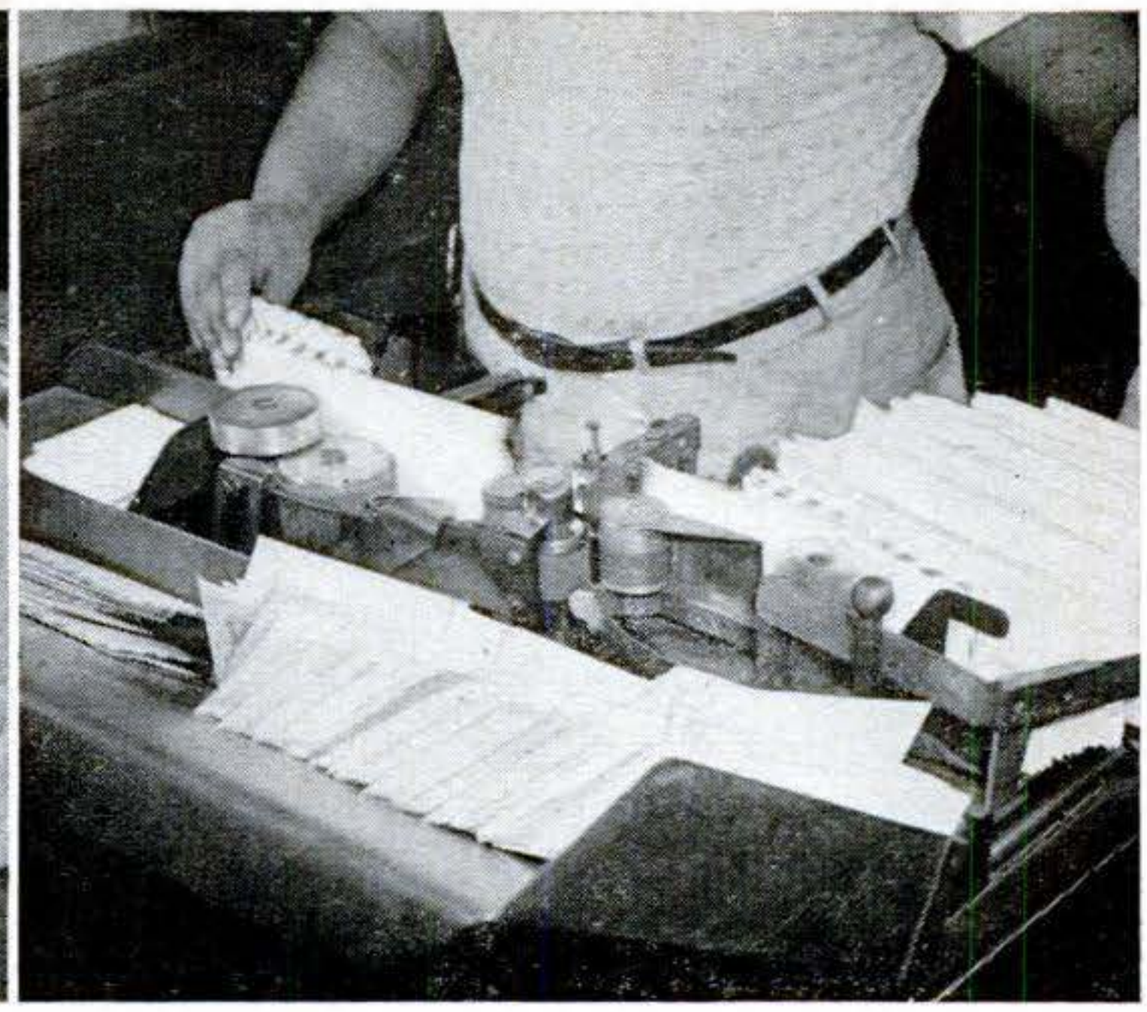
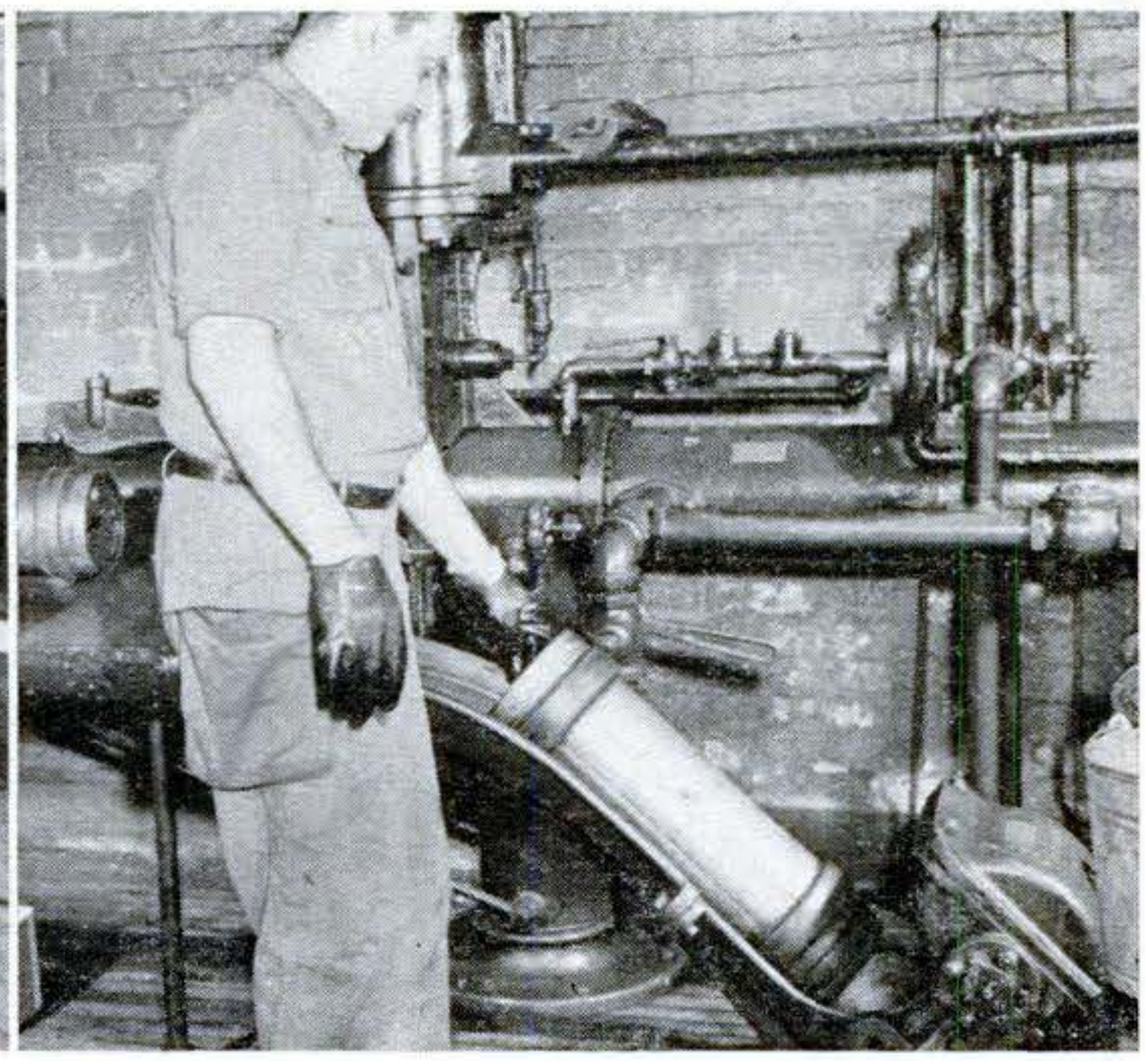


3 BACK AT TRIBOROUGH STATION at 1:10 P.M., he dumps bag on "face-up" table and arranges letters for cancellation. Here he puts air-mail letter in separate basket.



4 CANCELLATION MACHINE stamps city, date, time of day and name of local post-office station. This step is called "hitting off." Our letter will carry a 1:30 P.M. stamp.

6 OUR LETTER is somewhere in this bundle being tossed into a metal cylinder that will speed five miles downtown through underground pneumatic-tube to New York GPO.



7 AT 1:45 P.M. cylinder containing our letter leaves Triborough station via pneumatic tube, which is privately owned and leased to post office. [*Continued on next page*]

are surprisingly few "nixies"—letters so illegible or indefinite in address that they end up in the dead-letter office.

Clerks Must Be Detectives

At times it requires detective work to get a letter through. One clerk, for instance, tabulated 197 spellings for Chicago, including Zizabo, Jagjago, Jaiijo, Hipaho, Hizago, Shehego, Chaque-chico.

Then there are the wags who like to match wits with the post office. Some address letters in Morse code, in musical notes or by telephone numbers (the latter are ignored). The chemically minded use such tricks as H_2O Town for Watertown.

You can mail almost anything. Some articles are barred, however, such as poisons, explosives and live animals, except honeybees, day-old chicks, alligators under 20 inches and "other harmless creatures expected to reach their destination in good condition."

And if you want *your* mail to arrive in good condition on time during the Christmas rush (which is expected to add almost two billion pieces of mail), mail early, address painly, wrap securely.

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N.Y. GENERAL POST OFFICE TAKES OVER...

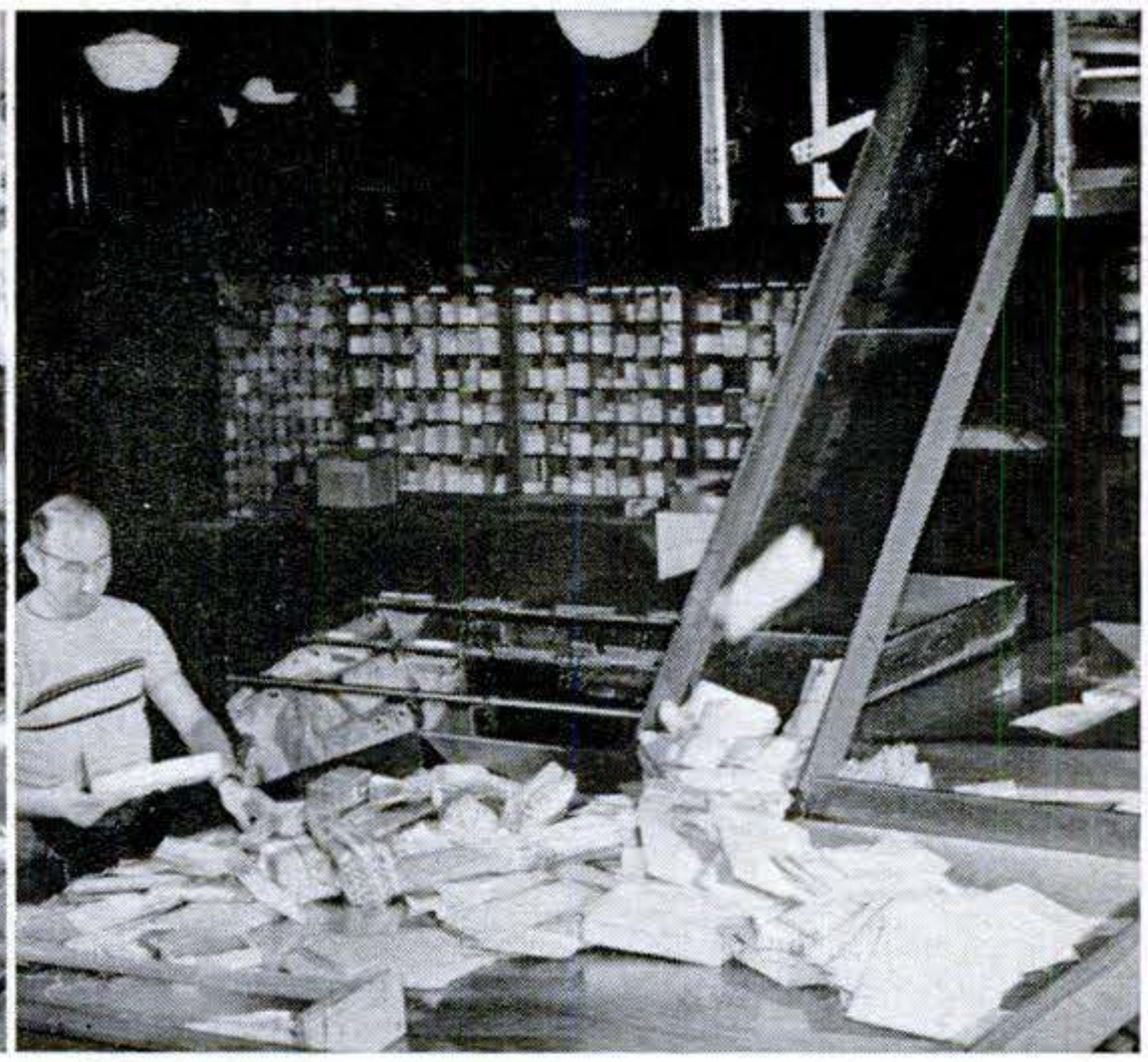
8 **NINETEEN MINUTES LATER,** at 2:04 P.M., cylinder shoots out of the tube system at GPO, in mid-Manhattan. Letters are dumped into conveyor belt in background that carries them up to "battleship," a distribution point so named by employees during construction of the building because its steel structure resembles superstructure of a battleship.

13 **LOS ANGELES AIR-MAIL POUCH** is locked and sent downstairs to outgoing transportation platform in time to be checked out on 3:40 P.M. truck to La Guardia airfield.

14 **AT LA GUARDIA** airfield post office, pouch is weighed in at 39 pounds. Dispatcher in background checks pouch out for Los Angeles on TWA flight departing at six P.M.

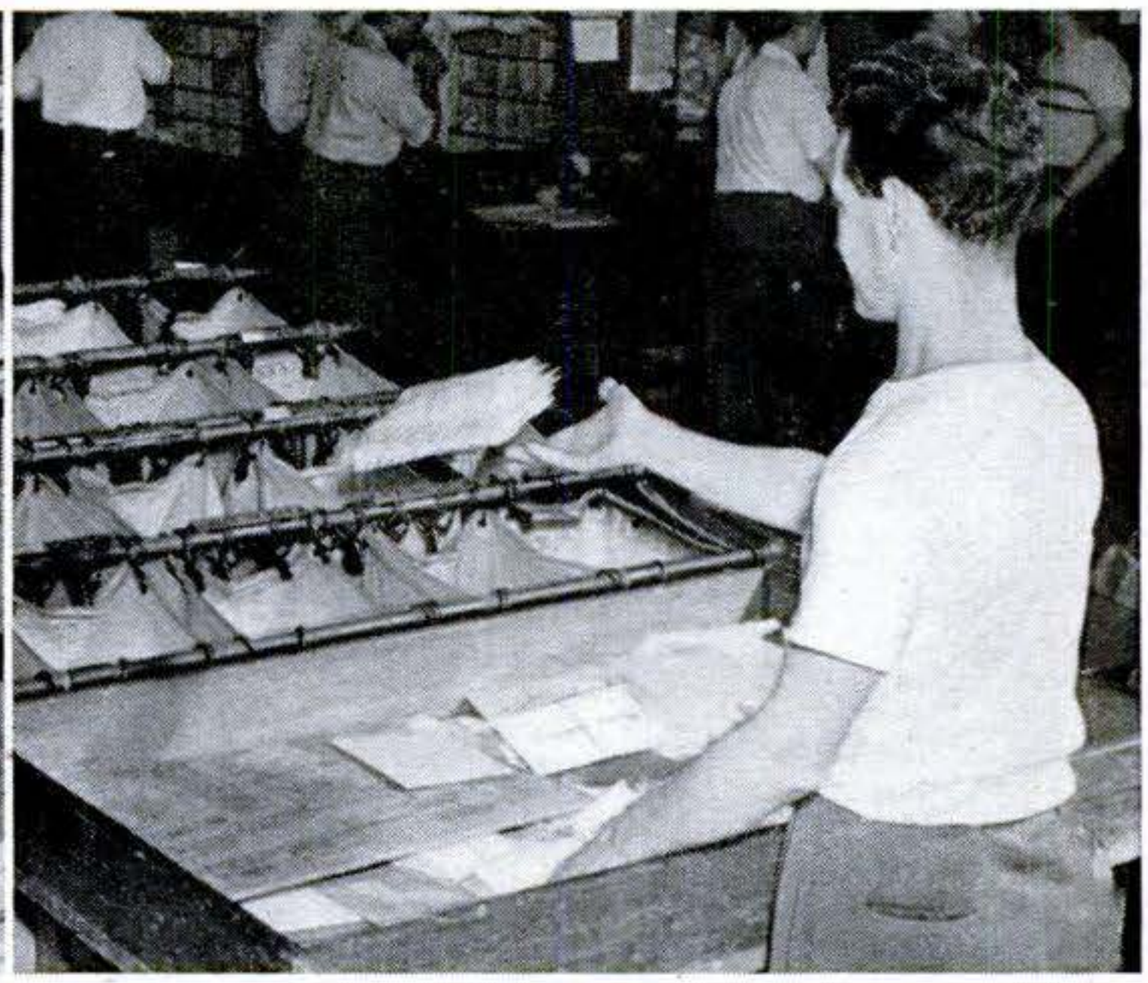
NEXT STOP IS THE AIRPORT...

9 **CONVEYOR BELT** loaded with mail bundles moves along "battleship," major routing point. Above, air-mail bundle is tossed into bin for re-routing to "Iron Horse."



10 **FROM "IRON HORSE,"** another routing platform, air mail is conveyed to air-mail pan (above) where bundles are cut open and sent to "separation."

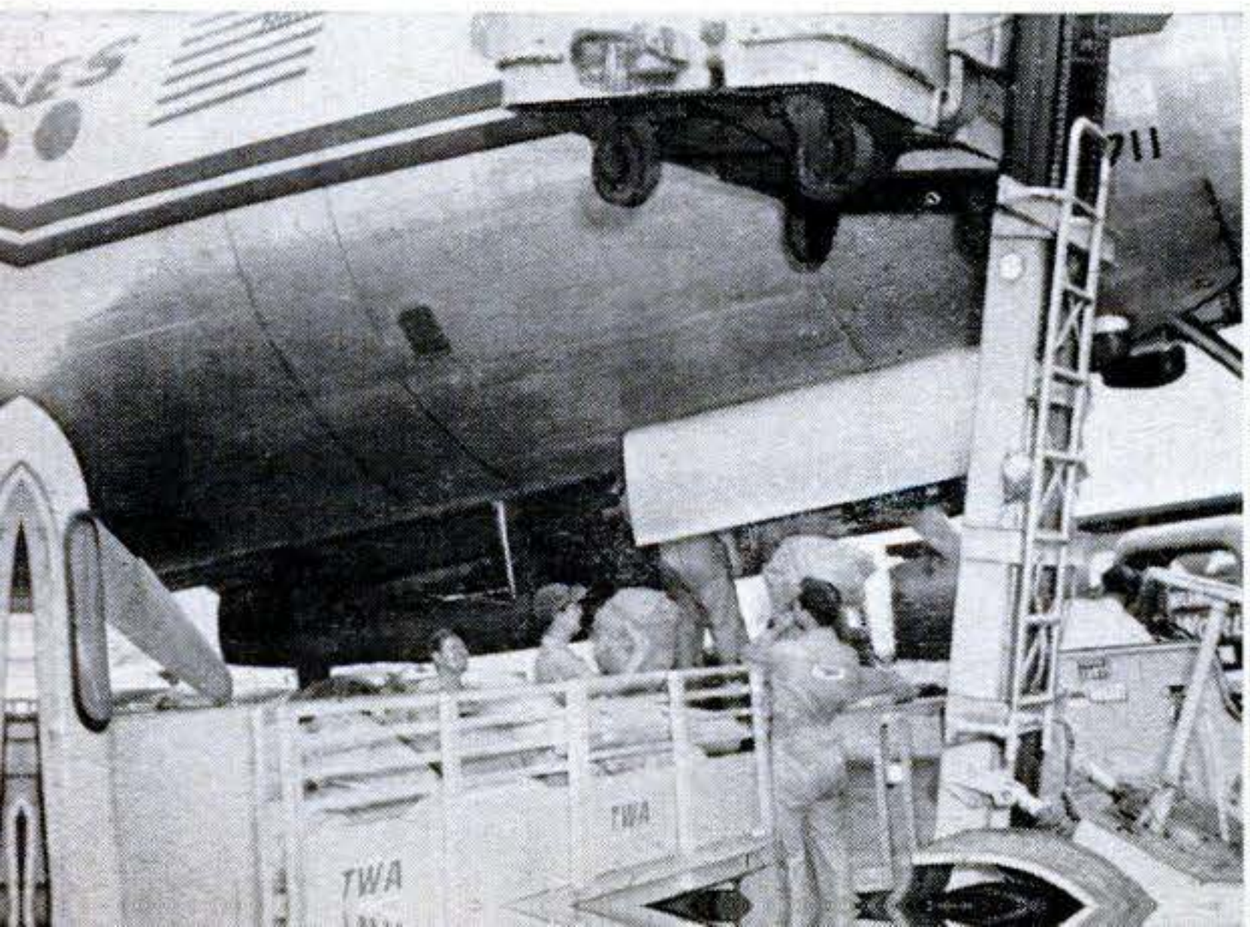
11 **AT AIR-MAIL SEPARATION BINS,** letters are pigeonholed according to states and large cities. Clerk above is putting a letter into Los Angeles bin. Maybe it's our letter.



12 **"SWEPT UP"** from separation and tied in destination bundles, letters go on wheeled tray to "pouching." Here clerk is tossing bundle into pouch for Los Angeles.

15 **SMALL TRAILER TRUCK** picks up mail from post-office platform and delivers it to waiting plane at 5:40 P.M. Airline employees load it into forward hatch.

16 **AT SIX P.M.** huge Constellation transport taxis out for take-off from La Guardia, one of more than 260 daily mail-carrying flights. [*Continued on next page*]



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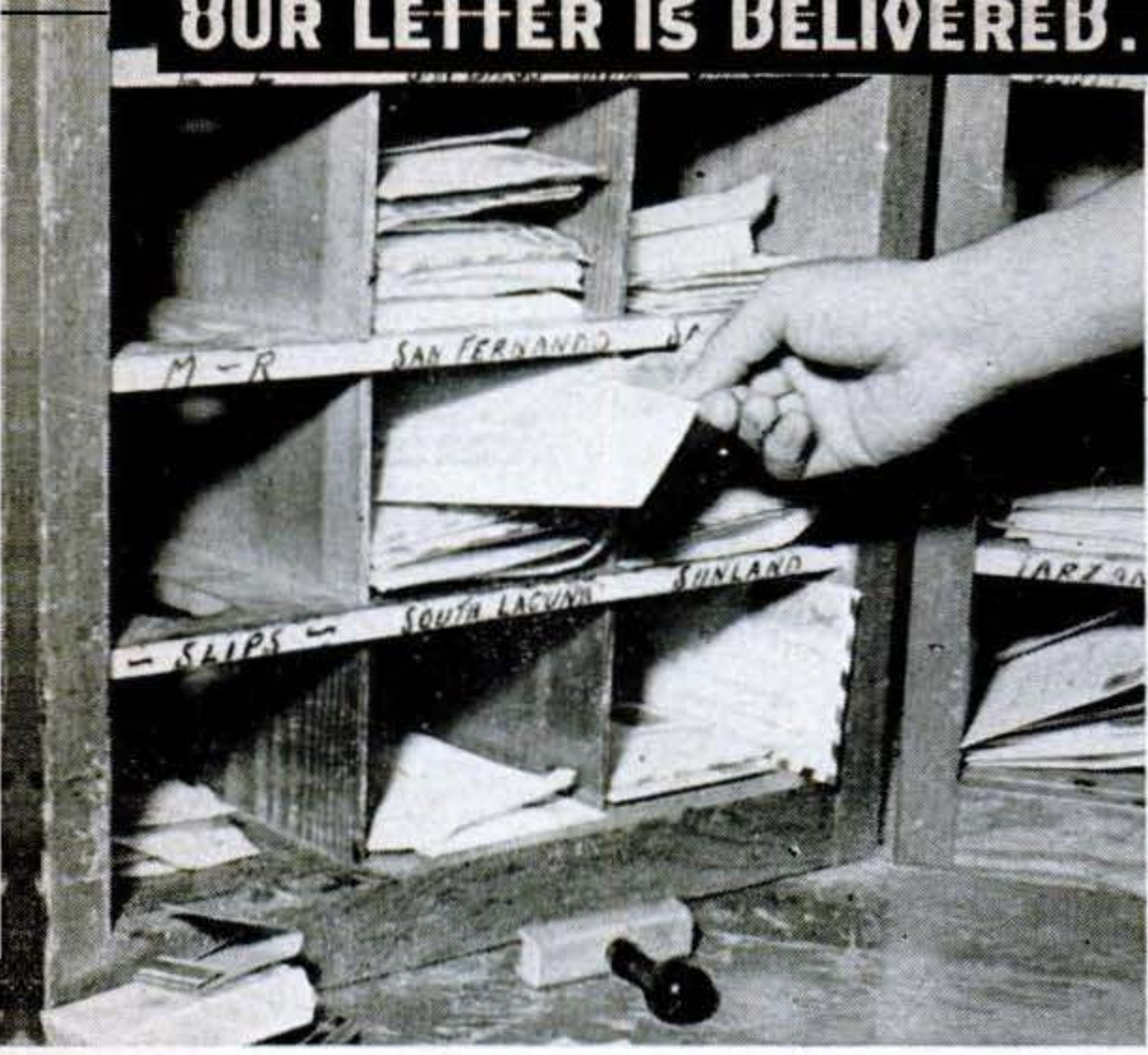
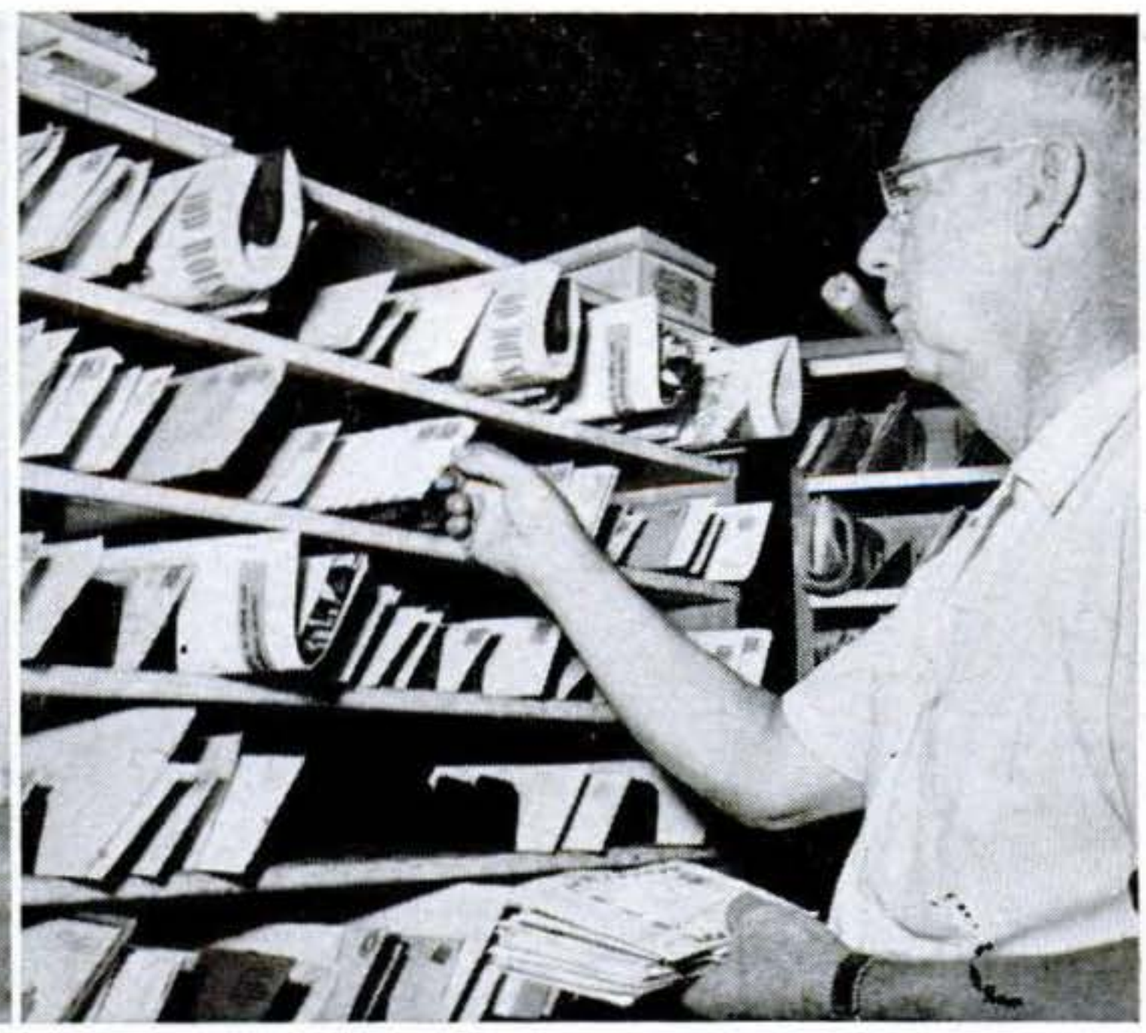
OUR LETTER IS DELIVERED...



17 **PLANE LANDED** at Los Angeles International Airport at 3:35 following morning. Field-post-office clerk above separates mail and puts letter in San Fernando box.

18 **AT 6:21** mail pouches labeled with towns of destination are loaded into cabin of a Sikorsky S-51 helicopter of the Los Angeles Airways. Take-off is at 6:25 A.M.

19 **SEVEN STOPS** and 56 minutes later the helicopter settles down in a vacant lot at San Fernando. Waiting mail-truck driver grabs his pouch and the 'copter is on its way.



20 **AT SAN FERNANDO POST OFFICE,** Thomas W. Salisbury, veteran carrier for RFD No. 1, "boxes" mail addressed to residents along his 50-mile route and ties it up.

21 **SALISBURY DRAGS THE MORNING LOAD** out to his car in a laundry-type basket—and at nine A.M. is on his way to deliver the mail to the 425 families along his route.

22 **TWO MILES** and 76 families later he hands our letter to Tom Carrell at 15541 Rinaldi St. It is 9:17 A.M. Pacific Time—total time elapsed 25 hours, 32 minutes.

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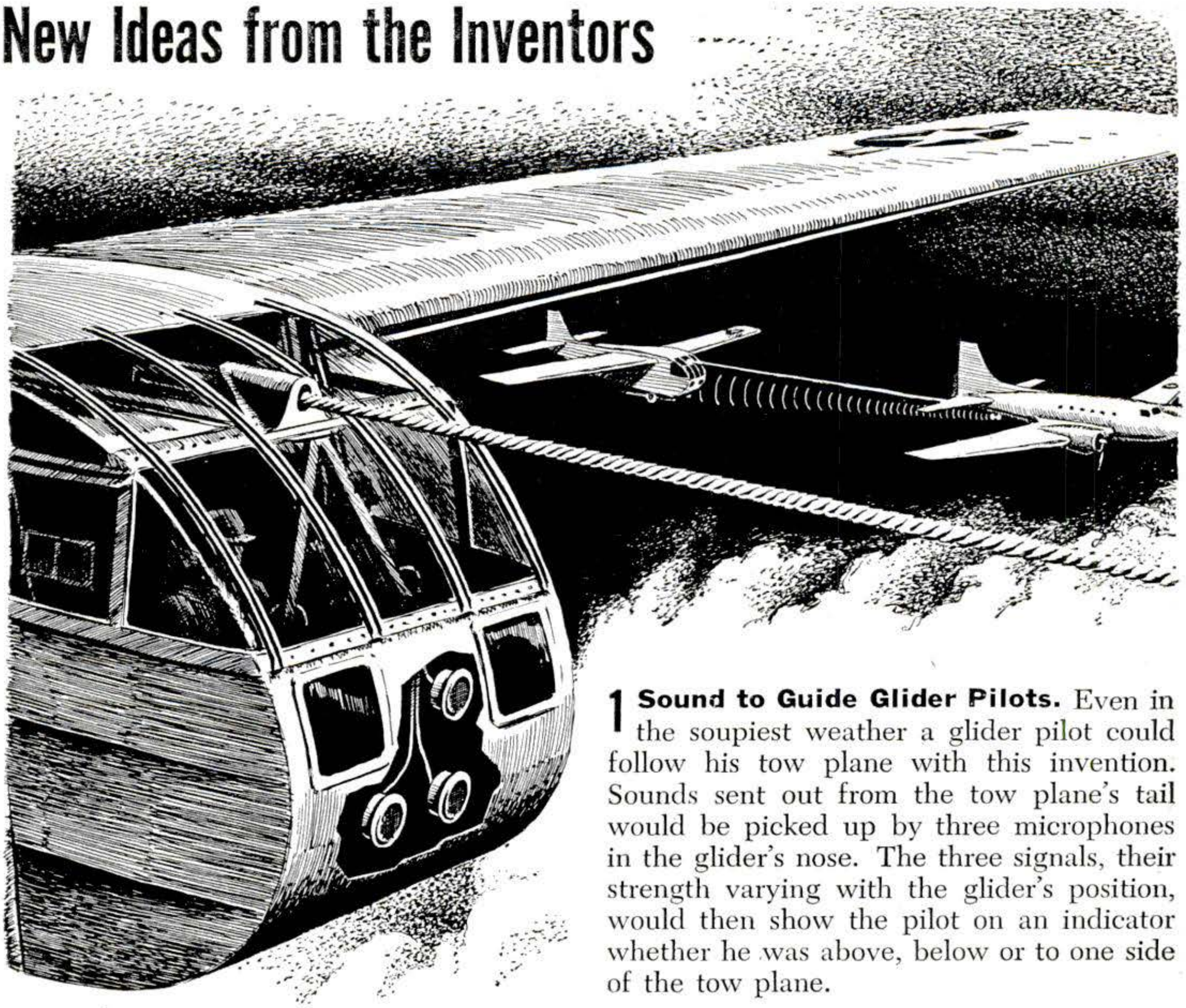
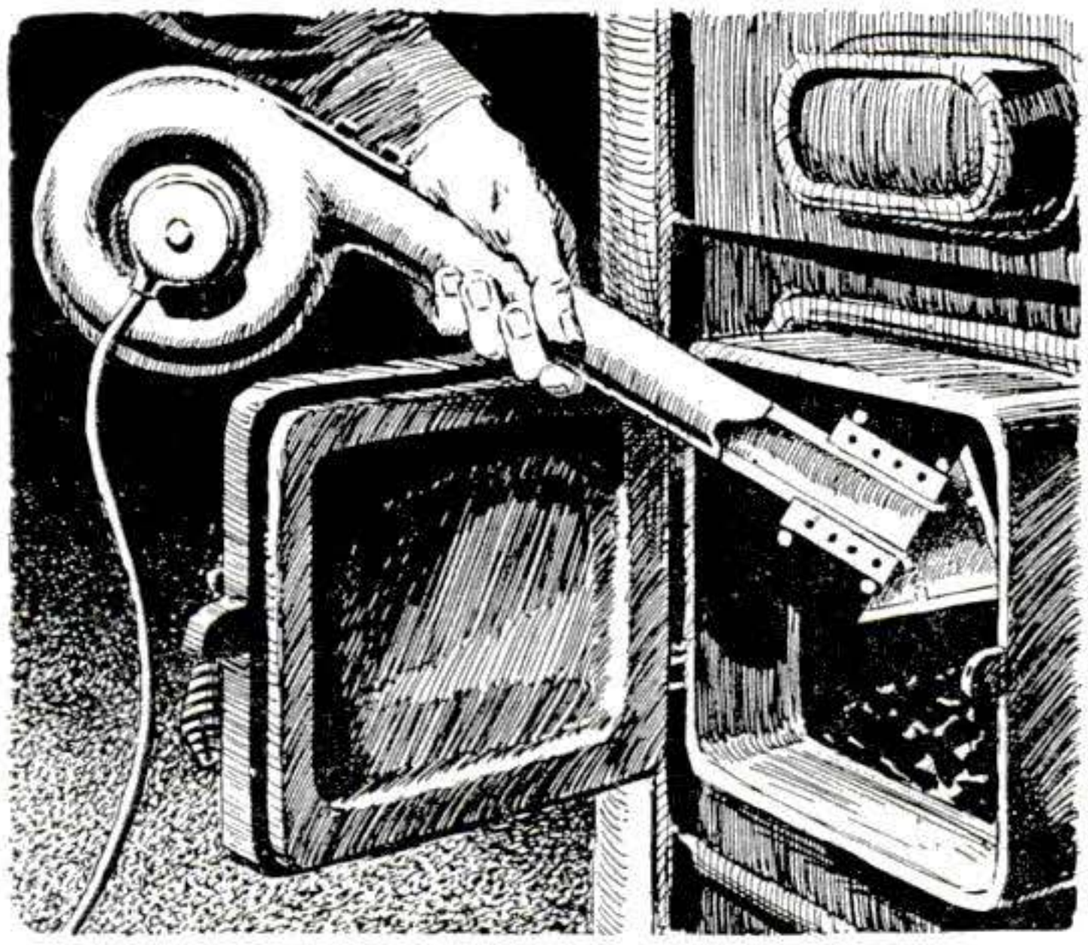
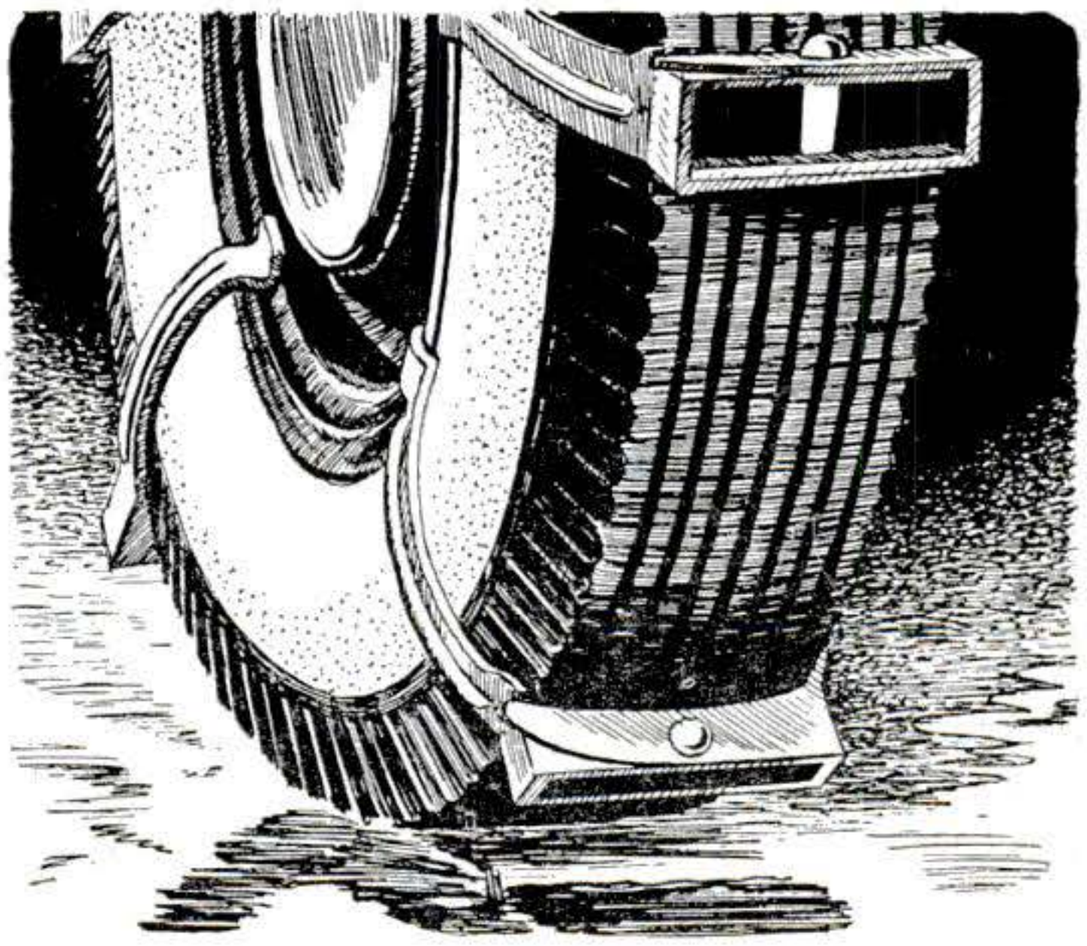
New Ideas from the Inventors



1 Sound to Guide Glider Pilots. Even in the soupiest weather a glider pilot could follow his tow plane with this invention. Sounds sent out from the tow plane's tail would be picked up by three microphones in the glider's nose. The three signals, their strength varying with the glider's position, would then show the pilot on an indicator whether he was above, below or to one side of the tow plane.



2 Igniter to Start Coal Fires. Here's a device to make it easier to start a coal fire in your furnace. It's an electric igniting element complete with a blower to help fan the coals and make them burn. The hot end would just be thrust into the coal after the appliance had been plugged into an electrical outlet.



3 Tire Clamps to Snap on. Pivoted in the center like a pair of scissors, the arms of these snow clamps would lock right on a tire without fasteners. The crossbar on each arm snaps against a shoulder on the opposite arm to keep the clamp from loosening. The car's weight on the pivoted crossbars presses arms tightly against tire.

Please turn the page for three more new ideas.

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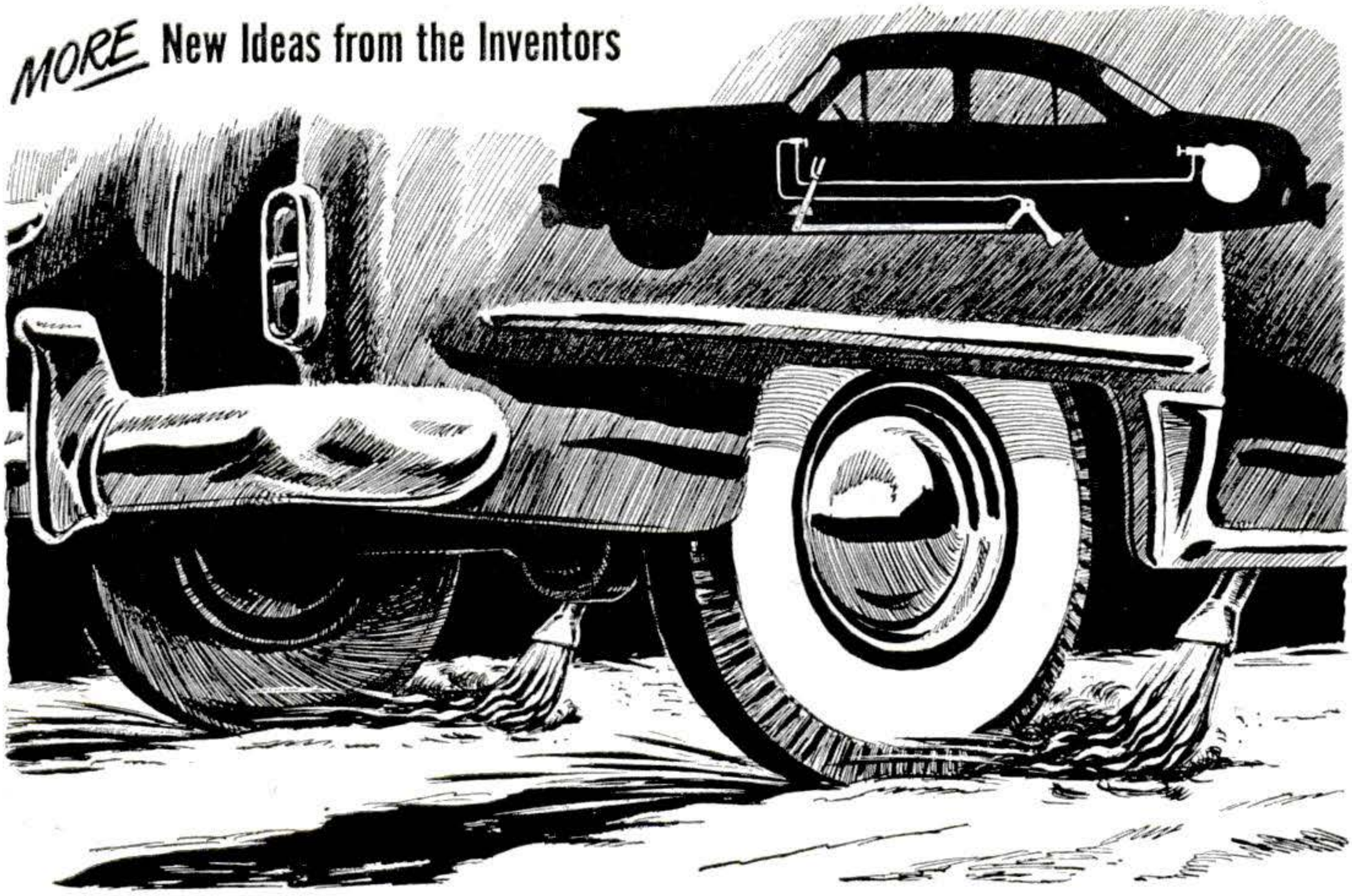
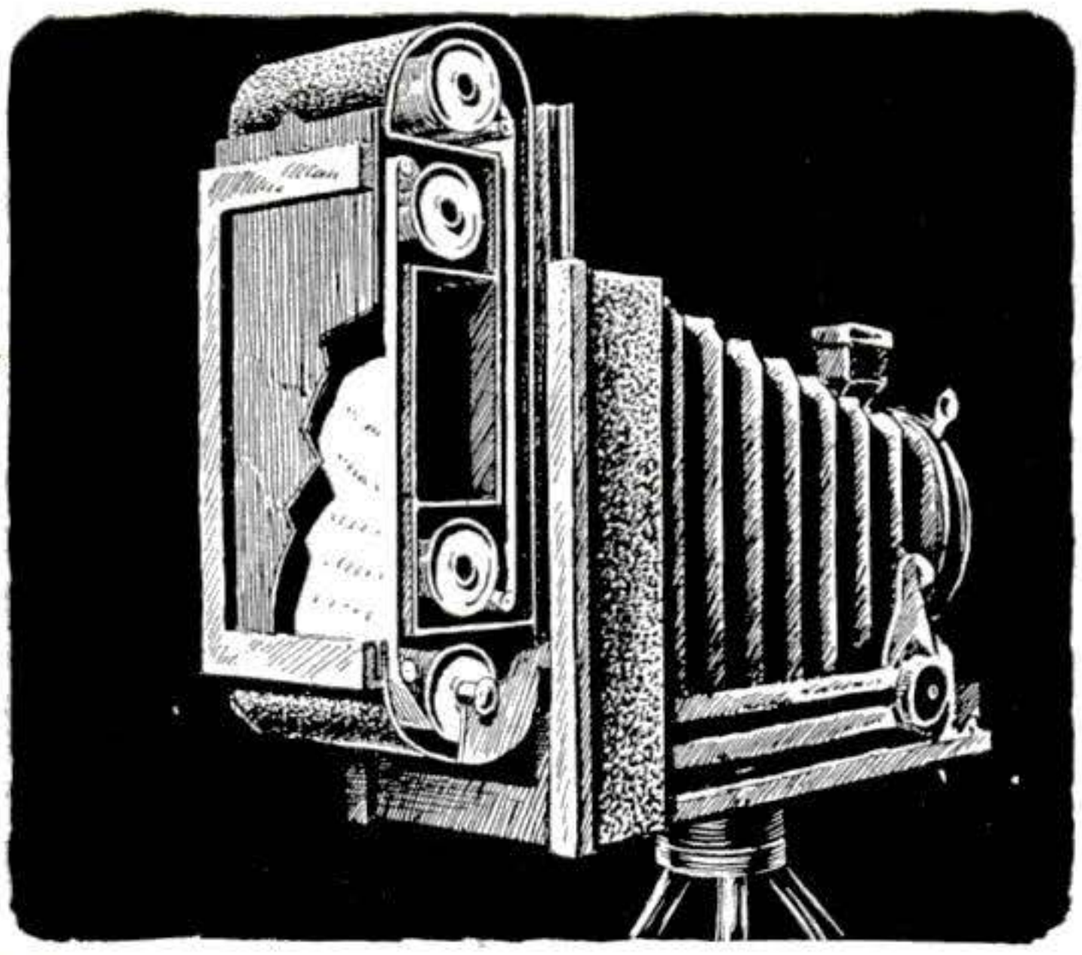
MORE New Ideas from the Inventors



4 Burners on Car to Melt Snow. You could get out of ice and snow in a hurry if your car were equipped with this device. When you turned a valve and pushed a button an electric spark would ignite fuel streaming from a burner in front of each rear wheel to melt away the ice and snow. The fuel, perhaps liquefied-petroleum gas, would be stored in a tank in your luggage compartment.



5 Camera to Hold Two Films. You could change back and forth between color and black-and-white films with the help of this invention. It proposes a film-holding attachment containing two sets of spools, with the films facing in opposite directions. To change from one film to the other, you would simply reverse the holder.

6 Clothesline to Eliminate Pins. Bothersome clothespins would no longer be needed if this line were used. Intended to be made of short sections of twisted wires, it would grip the laundry between the twists. When not in use, the sections would fold like an accordion into a small box, making storage simple.

Patents on these inventions have been granted to: 1. R. Wallace, Jr., Coolidge, Tex., and H. Ericson, Los Angeles; 2. W. Hall, Elkins, W. Va.; 3. H. Otis, Kansas City, Mo.; 4. J. Hamblin, Portsmouth, Ohio; 5. C. Smith, Flushing, N. Y.; 6. M. Ollman, Indianapolis.

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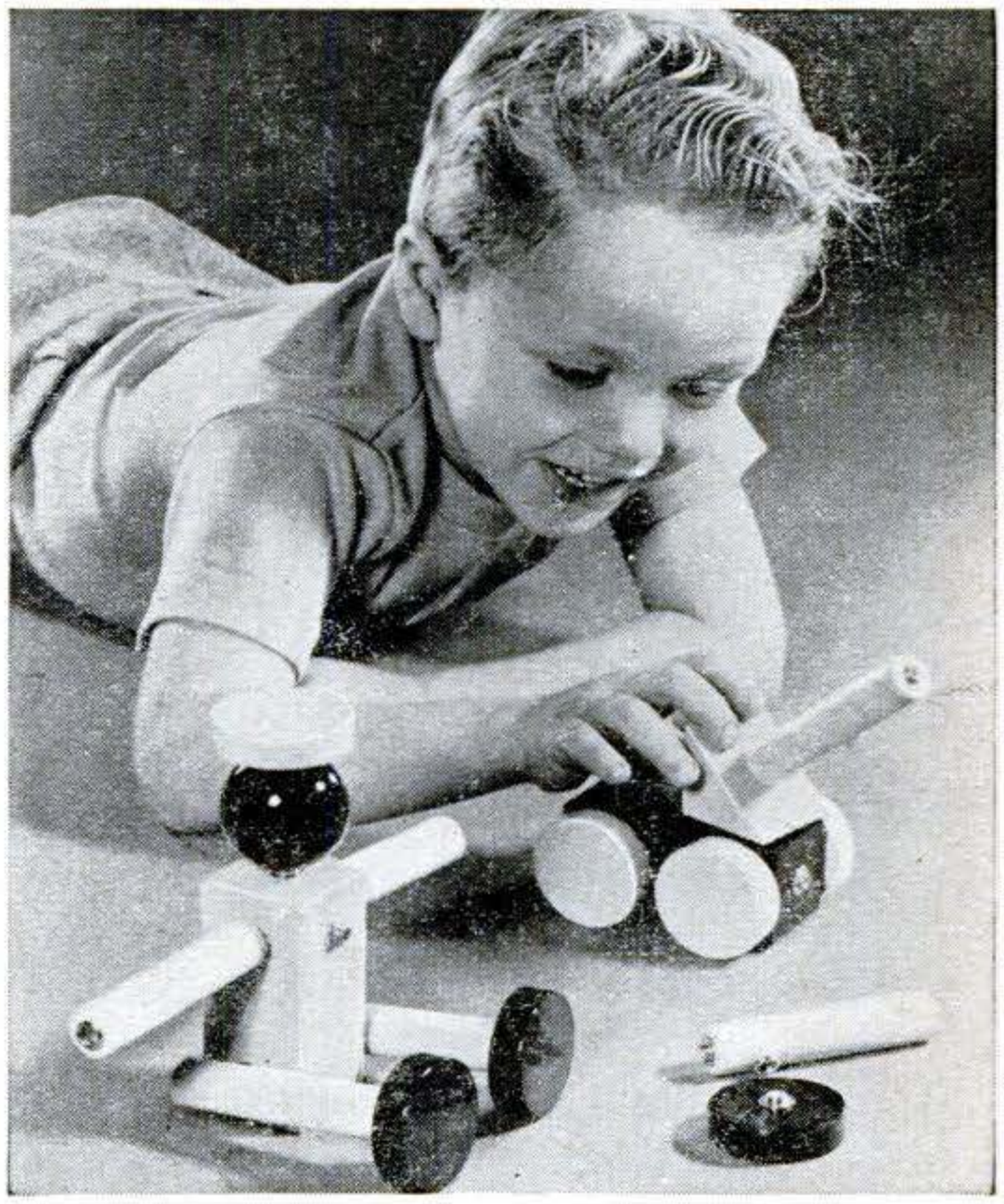
Radar Traps Lawless Fishermen

Fog no longer conceals commercial fishermen operating unlawfully within California's three-mile limit. Fast patrol boats manned by Fish and Game Division crews are cutting down illegal "net" profits as the roving eye of radar peers through haze or darkness to spot poachers. In two years, 25 boats have been stopped, 400 tons of fish seized, $39,000 worth of nets confiscated.

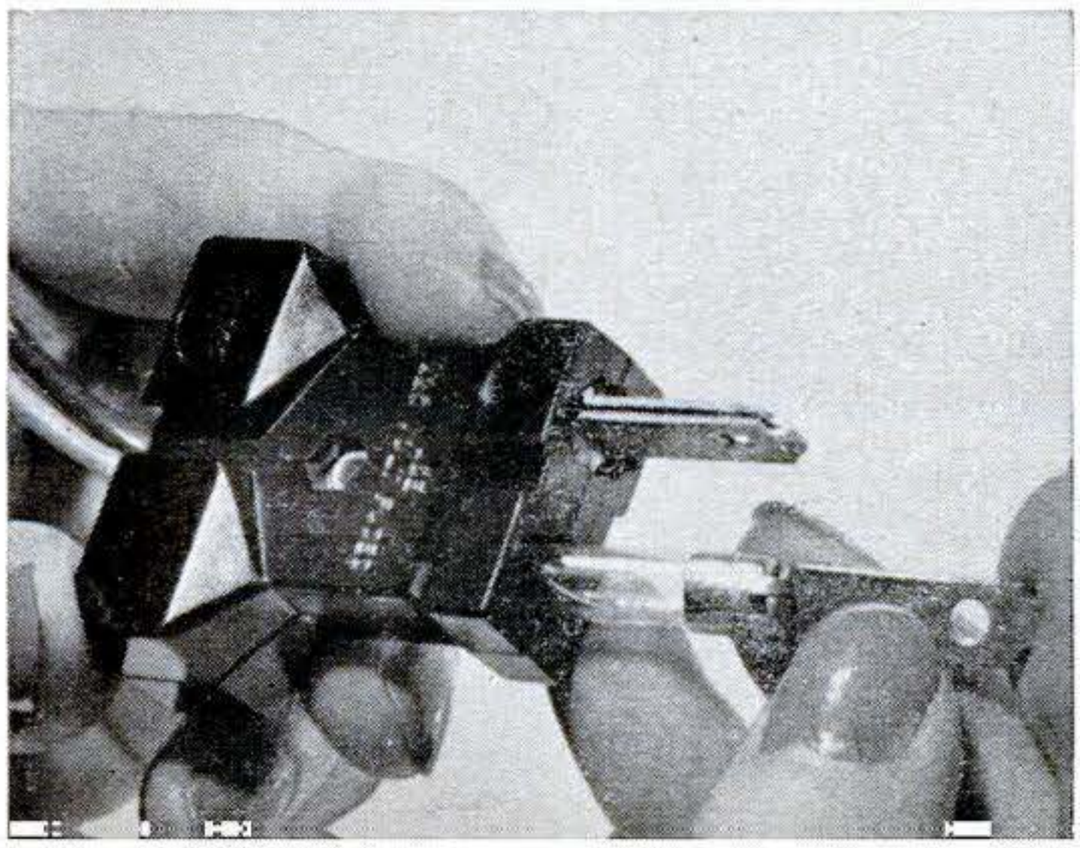


Plastic Blocks Snap Together

Plastic parts that are held together with snap fasteners form a new construction toy for the pre-school child. The snaps make it easy for tiny fingers to assemble the parts without complicated fasteners, and the basic shapes can be combined into many familiar objects. Available in bright colors, the toy is made by International Molded Plastics, Inc., of Chicago.

Fuse Plug Guards Tree Lights

If anything goes wrong with the lights on your Christmas tree, you won't be left in the dark with this fuse plug. Two easily replaced 5-amp. fuses, attached right to the prongs of the plug, prevent shorts or overloads from blowing a fuse in the house circuit and putting out all the lights. The plug is made by the Noma Electric Corp., N.Y.C.



Plane Seats Make Bed

A specially designed L-shaped mattress, placed over three of four facing seats in a 57-passenger Constellation, enables a bedridden patient to ride comfortably and leaves space in the fourth seat for a nurse or attendant. The unit is in use on the regular transport flights of the Chicago and Southern Air Lines.

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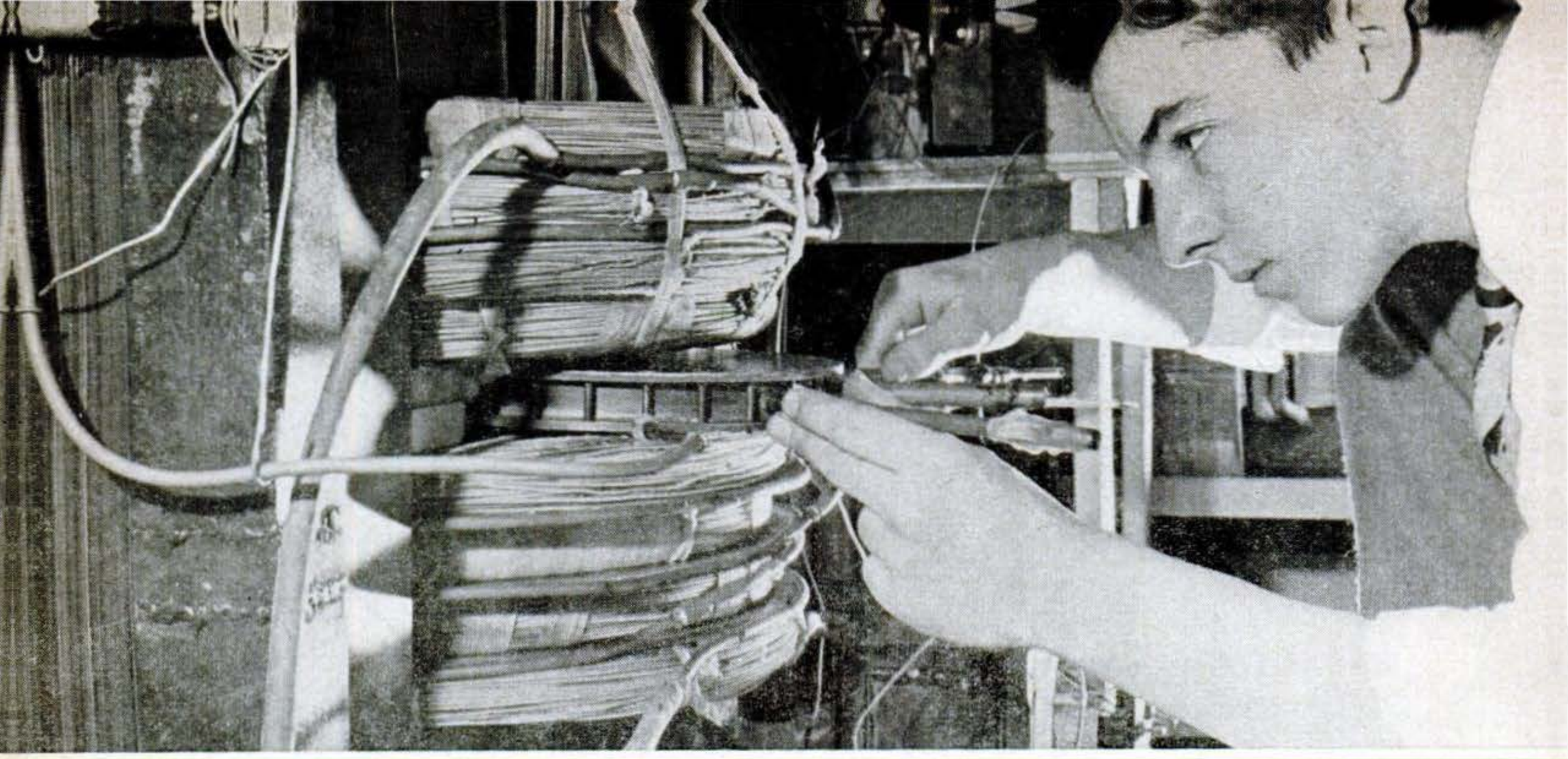


Robert Simpson, Kenmore, N. Y., high-school senior, built cyclotron, made top 10 last year.

Wanted: Science Talent

Scholarships await promising students who hurdle series of brain-busting tests.

By David O. Woodbury

MARINA PRAJMOVSKY came to this country from Finland when she was four. Her father was a Russian-born machinist, her mother a seamstress. While in high school at Farmingdale, N. Y., in 1942 she entered the first Science Talent Search, a competition held by the Science Clubs of America. Out of some 15,000 entrants Marina tied for first place.

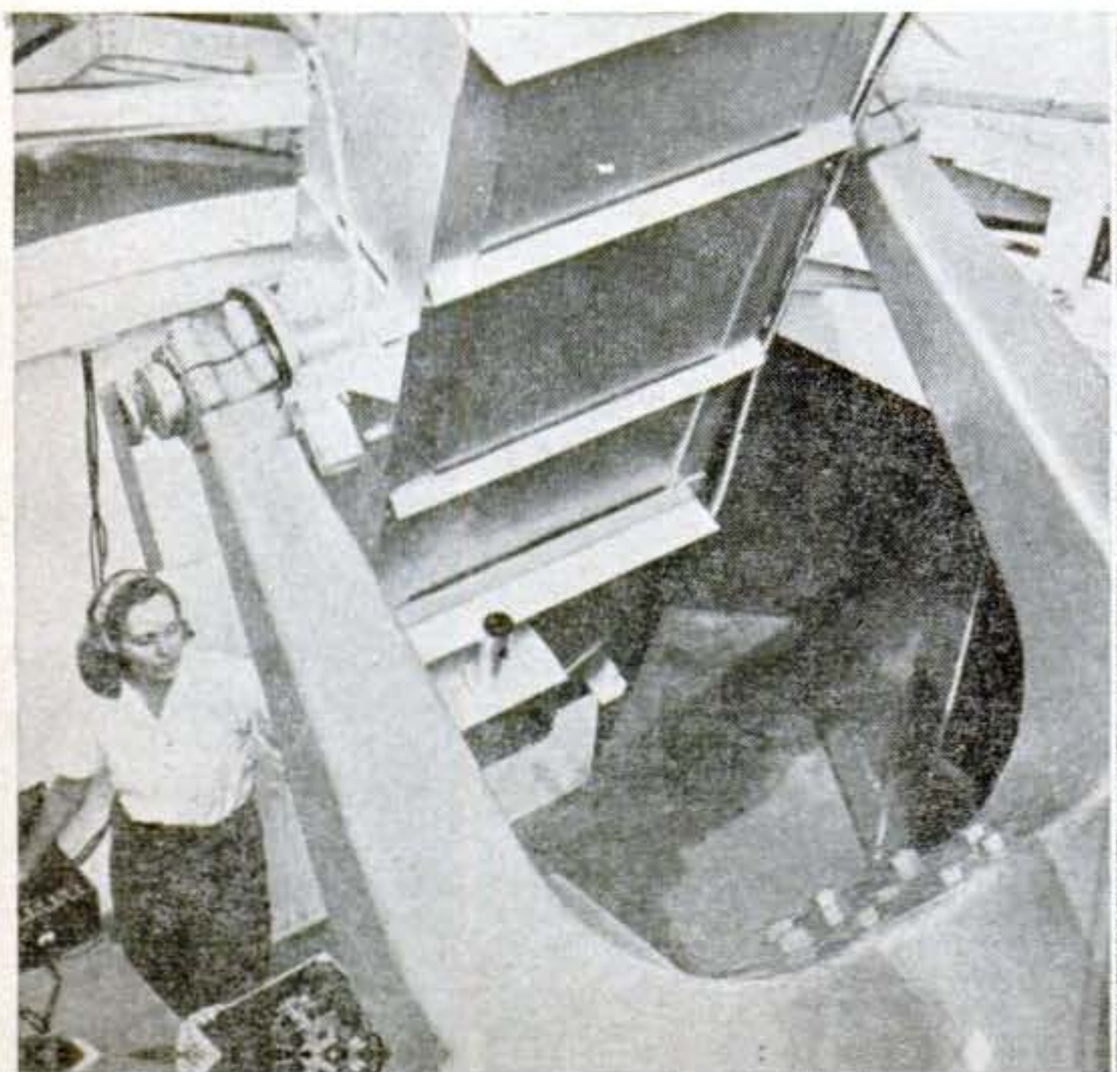
The Search's $2,400 scholarship got her started at Radcliffe. She graduated as the only *summa cum laude* in biology in the history of the college. In four years more she had a medical doctorate from Yale and now at 27 is doing research on eye diseases at Columbia-Presbyterian Medical Center in New York. Along the way she did highly secret work for the Navy and carried out outstanding research on DDT.

Without the help and inspiration of the Talent Search, this brilliant immigrant girl might have been lost to the world of science.

Around Christmas time this year the

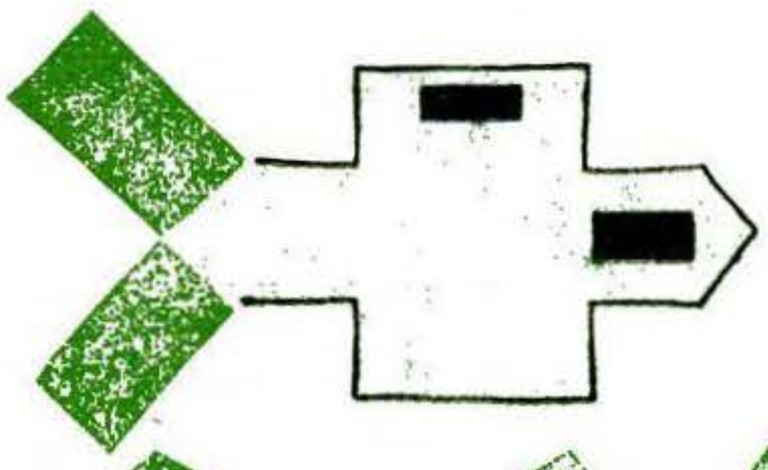
1946-WINNER GORDON NEWKIRK, JR., and 1944-winner Joyce Marrison (below) worked together in the summer of 1948 at Harvard Observatory. Now they are Mr. and Mrs.

INSECT-DISSECTING STAND machined from salvaged metal was exhibit brought by Robert Kraichnan to 1944 Talent Institute. A winner, he later became Einstein's assistant.

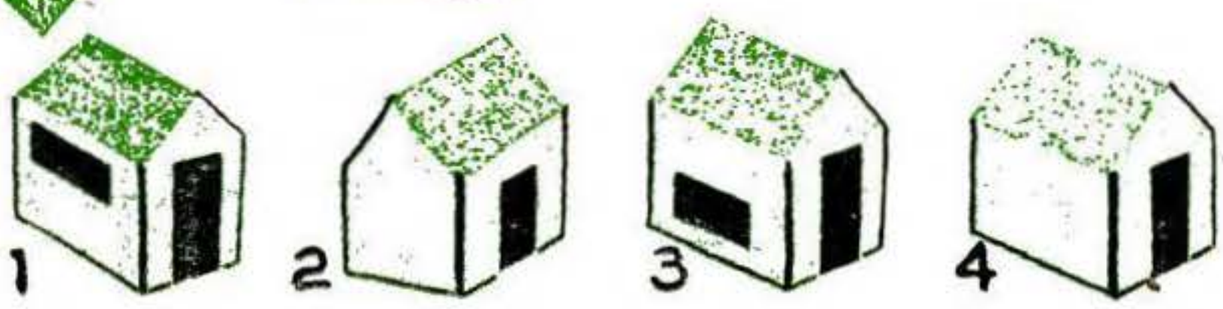


Score yourself on these questions from the science scholarship exams

ANSWERS ON NEXT PAGE



1 **Which of these** three-dimensional figures can be made by folding the pattern?
( )1. ( )2. ( )3. ( )4.



2 **This is a diagram** of a spring similar to a hairspring in a watch. It is classified as a

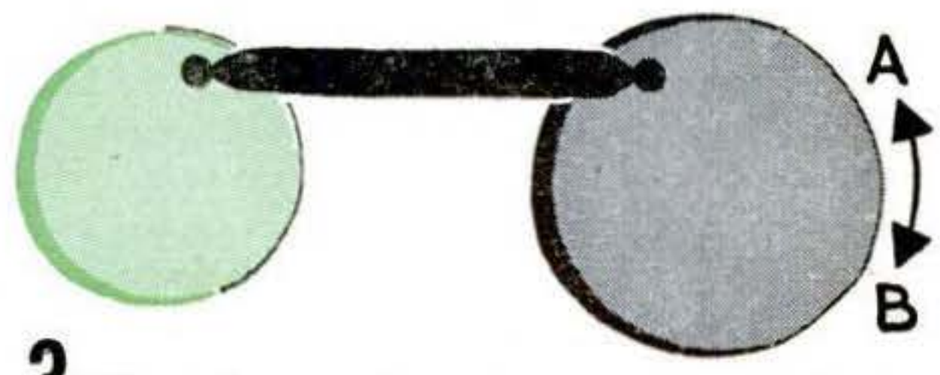
( ) 1. compression spring
( ) 2. disk spring
( ) 3. leaf spring
( ) 4. torsion spring

Search will launch its eleventh aptitude test for thousands of bright high-school seniors in every state. The kids will tackle the toughest two-and-a-half-hour exam of their lives; 300 of them, ranging from 15 to 18, will pass. The top 40 will go to Washington to be judged still more rigorously and eventually receive financial aid without which many of them could not go to college.

The other 260 will be recommended to colleges as exceptional material. In 10 years this good word has never failed to bring every winning contestant a scholarship offer. So far 3,000 winners have been launched on promising scientific careers, thus helping to fill the dangerously low pool of scientific man power.

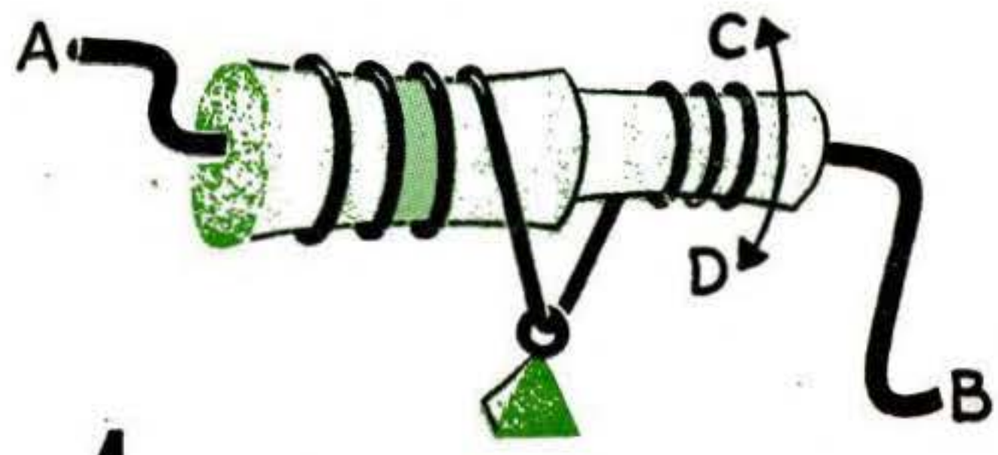
Along with the aptitude test every candidate must hand in a 1,000-word essay on

INVESTIGATING CARDIAC-INJURY POTENTIALS is part of the research carried on at University of Wisconsin by Paul Cranefield, Jr., of Columbus, Wis., a 1942 award winner.



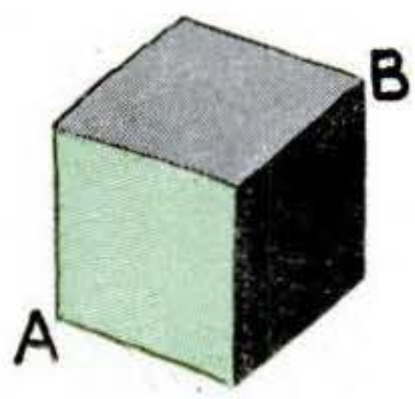
3 **When the smaller wheel** rotates clockwise, the larger wheel will:

( ) 1. rotate in direction A
( ) 2. rotate in direction B
( ) 3. move back and forth
( ) 4. prevent rotation of the smaller wheel



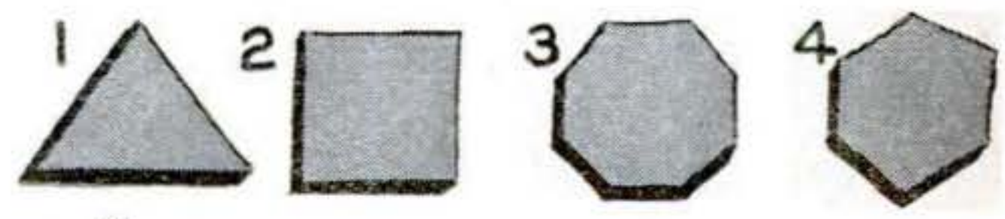
4 **In the differential windlass,** with which crank and turned in which direction, can a weight be raised most efficiently?

( ) 1. A, C ( ) 2. A, D ( ) 3. B, C ( ) 4. B, D



5 **Suppose a cube** was cut in two at right angles to the diagonal AB, and just halfway between A and B. Which figure best represents the shape of the cut surface?

( ) 1.. ( ) 2. ( ) 3. ( ) 4.



6 **The symbol !** after a number indicates that it is a factorial. Thus 4! equals 4 x 3 x 2 x 1. Which of the following equals 5?

( ) 1. 5! ( ) 2. 5! – 4! ( ) 3. $\frac{5!}{4!}$ ( ) 4. 5! x 4!

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FIRST AWARDS WERE MADE IN 1942 to Marina Prajmovsky of Farmingdale, N. Y., and Paul Teschan of Shorewood, Wis., by Westinghouse president Andrew W. Robertson.

"my scientific project." This means a piece of first-hand research, carried through to a finish. Science teachers everywhere coach their best students and help them find projects. To produce a Search winner is about the highest honor a school can have nowadays.

Thousands of bright kids can knock over the test, but the essay really weeds them out. It takes a natural-born scientist to carry out a useful research and report lucidly upon it at the age of 16. Yet, many of the papers read like reports by mature scientists.

Contestants' Work Is of Real Value

Nancy Durant, a 15-year-old Negro girl from a Washington high school, handed in an essay proposing the use of sodium tungstate for fireproofing fabrics—a valuable new method. Lee Hershenson, 16, from Pittsburgh, discussed synthetic rubber through 10 pages of intricate chemical formulas, a report worthy of commercial researchers in the field. Marina Prajmovsky's essay, on osmosis in living tissues, was excitedly acclaimed by the university chemistry professor to whom it was referred.

The 1943 crop of essays discussed atomic energy so penetratingly that Search officials feared the Army might hush them all up. Instead, two of the contestants, drafted while still in college, found themselves on duty with the atomic-bomb project.

Every so often a natural mathematician turns up in STS. Saul Kravetz, 17, handed in a paper on "The Calculus of Variations"—a brain-buster exploring a problem still in debate by world experts. The judges were completely stumped by its six pages of solid equations and had to call in a Bureau of Standards specialist to tell them what they meant.

Talent Search disclaims any effort to pick geniuses. It merely uncovers talent for pioneering and original thinking. All-around citizens in the making, these are the men and women who will dedicate themselves to lifetimes of service, most of it modestly paid.

About a third of the winners come from towns of less than 10,000 population. Many earn their own way as professional musicians, mechanics, stenographers, gardeners and store workers. Without exception these talented youngsters' interests cover many fields. All of them belong to school clubs, many are letter athletes. Others write for the school paper or go in for dramatics.

War Pointed Up Need for Scientists

Though the Search is now recognized as a vital contributor to the ranks of American scientists, it started in an offhand way. Early in 1942 the sudden pressure of war produced a crying need for scientific brains. G. Edward Pendray, then with Westinghouse Electric, was attempting to set up a national organization of school science clubs around a nucleus of a few already in existence around New York. It wasn't going well. Watson Davis, director of Science Service, a nonprofit educational organization in Washington, heard of Pendray's troubles and offered to take over the job. Science Clubs of America was thus formed. From Westinghouse, Davis inherited Margaret E. Patterson, a former science teacher. "Pat" at once became the moving spirit of the clubs.

But Davis, Pendray, Miss Patterson and Dr. Harlow Shapley, who was president of Science Service, agreed that the science clubs were not enough. Something more

[Continued on page 244]

ANSWERS TO QUESTIONS ON PRECEDING PAGE.

(1) 1	(2) 4	(3) 3
(4) 3	(5) 4	(6) 3

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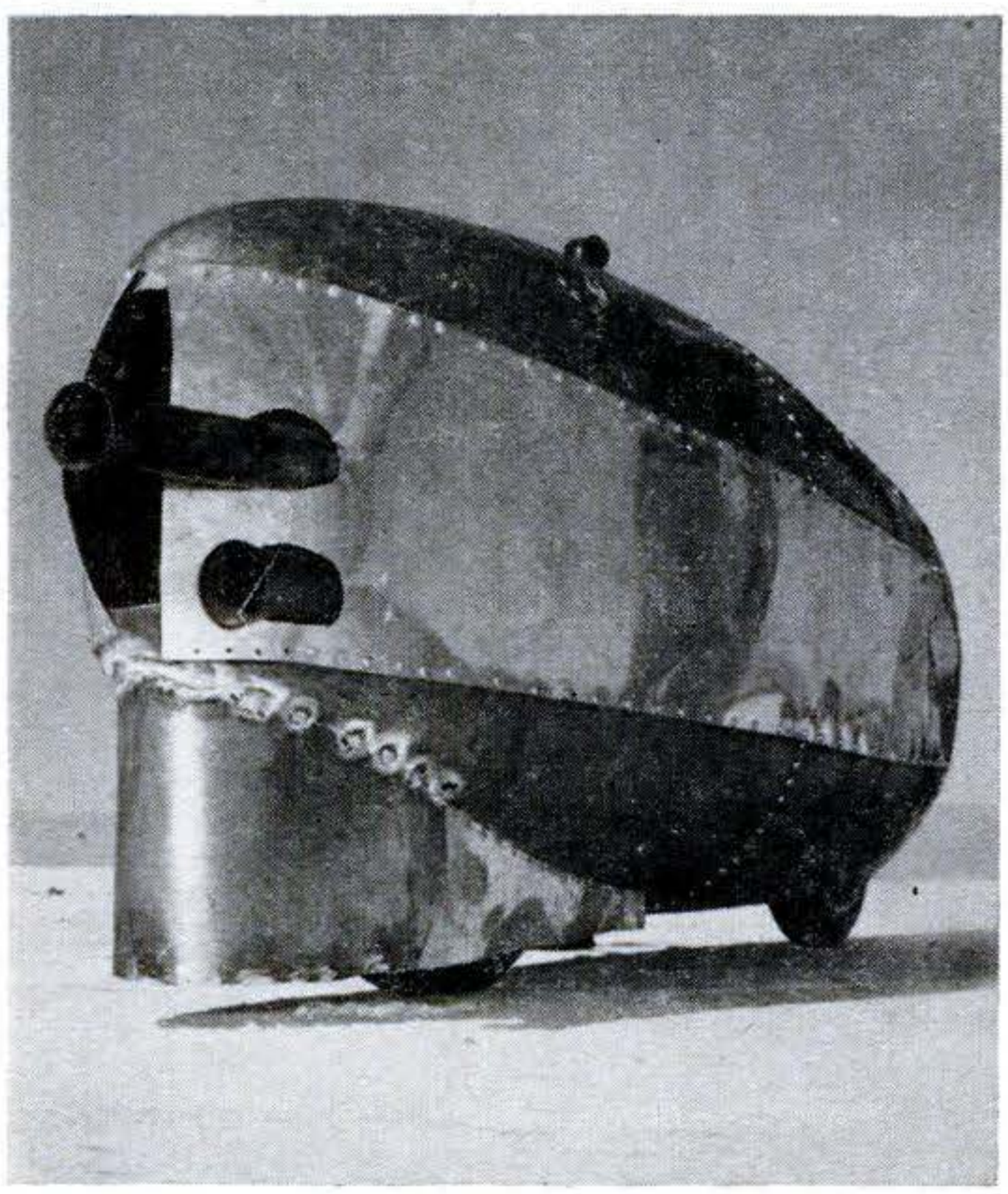
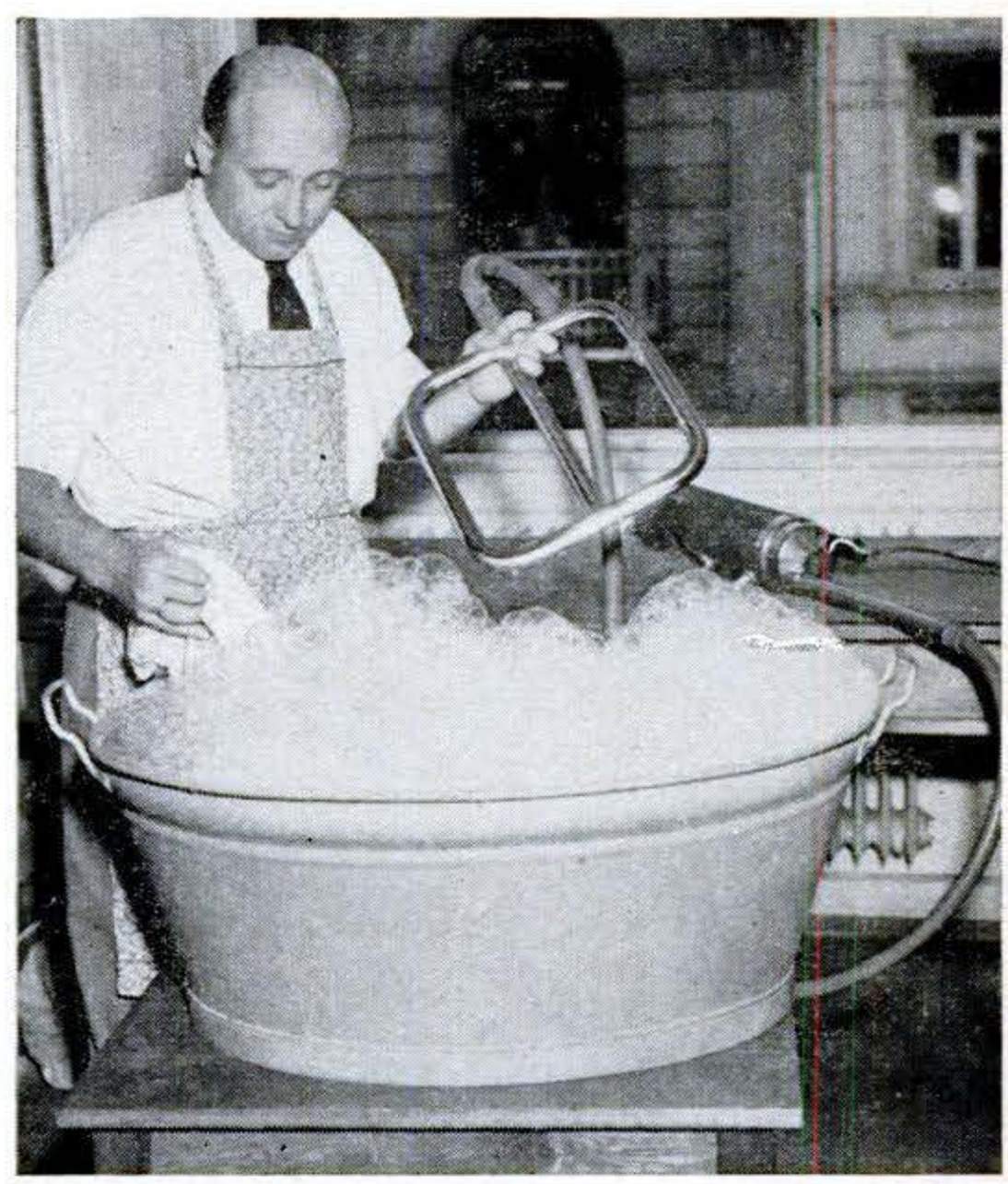
Battlefront Now Equipped with Hot and Cold Running Water

FOXHOLES with built-in showers used to be an Army joke. But not any more. This new mobile unit brings hot-water showers close to the front lines. The two-wheel trailer is towed by jeep to a river or pond from which a pump draws water to the boiler. Heated scalding hot to kill harmful organisms, it then flows through tubes surrounded by incoming water, cooling it to the right temperature, and on to 24 showers.



Motorcyclist Goes Undercover

HIDDEN under that aluminum kimono is a motorcycle, converted by Chick Herbert of Los Angeles to see what streamlining would do for his 80-cubic-inch Harley-Davidson. Nicknamed "the Beast," the machine's horn-like projections ram air into the carburetor. Herbert rides on his stomach.



Vacuum Cleaner Does Wash

THE mass of soapy bubbles in this wash-tub was formed by the perforated steel tubing in the hands of its German inventor. Attached to the blower of a vacuum cleaner and placed in the bottom of the tub, it is said to do an effective job of clothes-washing with a third the soap normally used.

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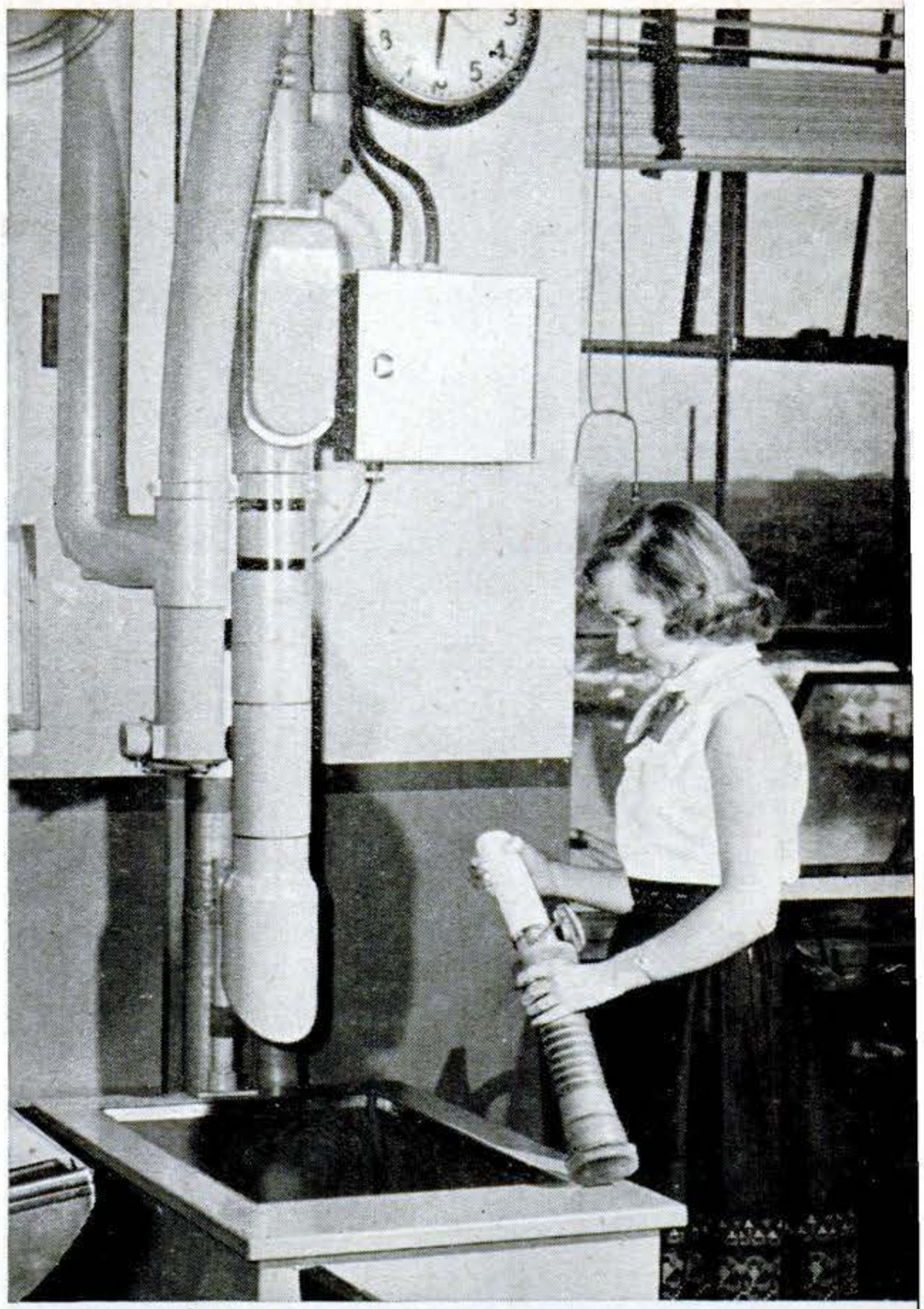
Dial Switches Message Tubes

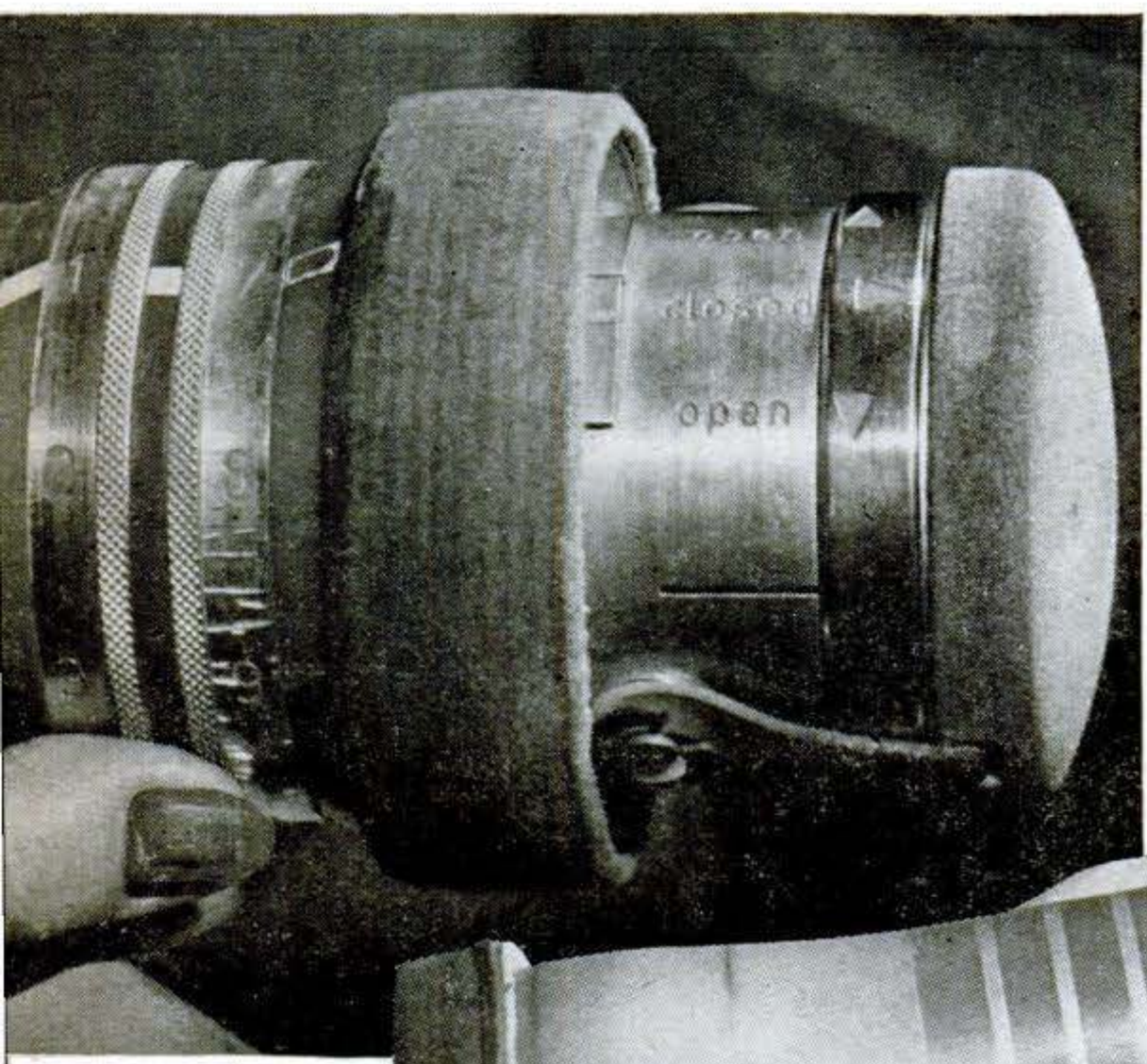
BY DIALING a number, workers in a Connecticut factory can send written messages and even metal samples to various parts of the plant in about a minute's time. They are using the familiar old pneumatic tube, the hissing, clanging gadget used to make change in many department stores.

This pneumatic tube is different. Where older systems required separate tubes to each station, this one has an automatic dial exchange, just like a modern telephone central office, making a few tubes do the work of many. Each carrier has numbers that can be set to guide it automatically to any one of the nine stations that make up the first American installation at the Housatonic plant of the Bridgeport Brass Co. Eventually there will be 20 stations.

In use abroad for some time, the tube exchange was developed in Germany by Mix & Genest, a subsidiary of International Telephone and Telegraph.



ORDERS PUT IN CARRIER at this station, one of nine in Bridgeport Brass Co.'s automatic pneumatic-tube system, are rushed in 53 seconds to rod-and-wire mill that will fill them.



TO "ADDRESS" A CARRIER—say, to Station 17—you turn a pair of adjustable rings, which bear numbers from zero to nine. When "1" and "7" are aligned with a white mark, as at left, carrier is correctly set. Turning the adjustable rings has effect of varying internal electric connections between 10 contact rings, seen in full-length view of carrier below.

CARRIERS of Bridgeport installation fit four-inch tubes. An alternate system, using carriers that fit three-inch tubes, is illustrated at bottom of opposite page.

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ALL CARRIERS PASS THROUGH AUTOMATIC EXCHANGE, WHERE SENSING DEVICE AND SWITCHES ROUTE THEM TO DESTINATION

2 ELECTRIC FINGERS SENSE DESTINATION OF CARRIER, AND ACTUATE RELAYS, SETTING SWITCHES OF EXCHANGE

3 SWITCHES GUIDE CARRIER INTO CORRECT "LOOP" OR BRANCH

4 SWITCH DIVERTS CARRIER INTO CORRECT EXIT TUBE. (THIS SWITCH MAY RESPOND TO SENSING DEVICE AT EXCHANGE, OR TO ANOTHER SENSING DEVICE NEARBY)

FROM EXCHANGE

FROM EXCHANGE

RECEIVING STATIONS

RECEIVING STATIONS

TRANSMITTING STATIONS

TO EXCHANGE

TO EXCHANGE

TRANSMITTING STATIONS

1 PRESET CARRIER IS DISPATCHED FROM TRANSMITTING STATION

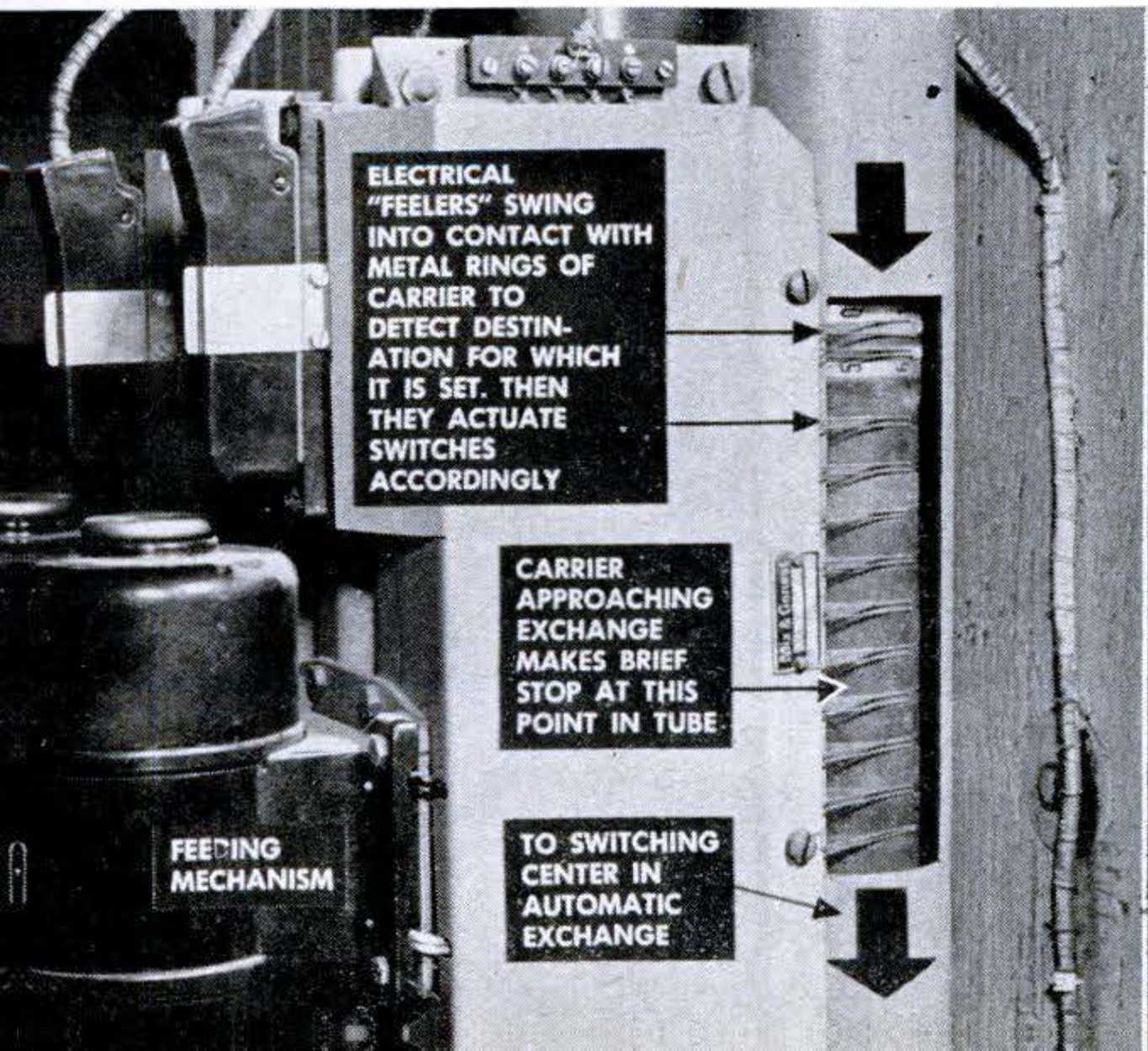
IF CARRIER IS DIALED BY MISTAKE FOR A NONEXISTENT STATION, IT DROPS THROUGH REJECTION TUBE, TO BE INSPECTED AND HAVE SETTING CORRECTED

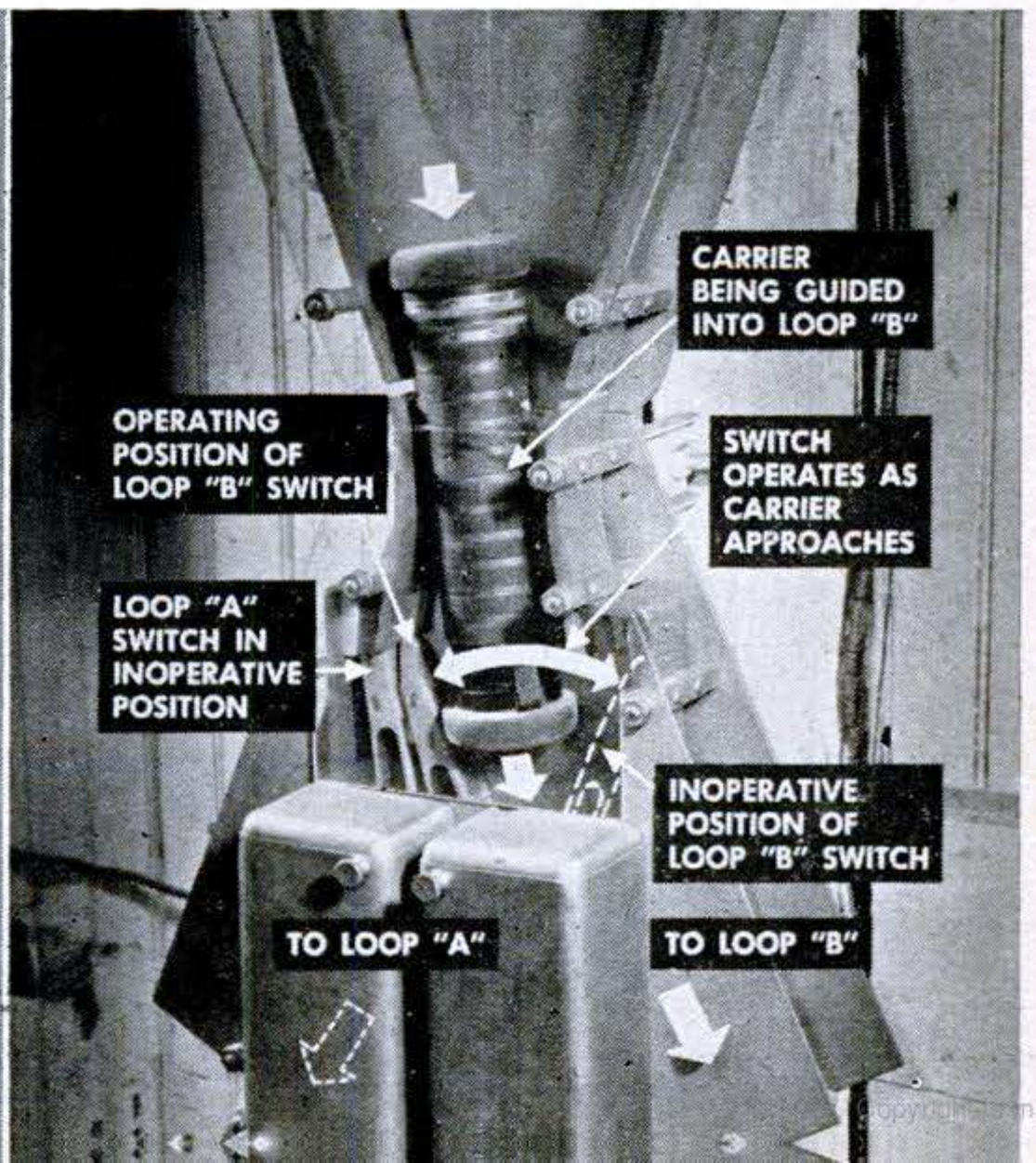
5 CARRIER ARRIVES AT RECEIVING STATION

TYPICAL PNEUMATIC-TUBE SYSTEM with automatic exchange has layout like this. Two "loops" of tubing extend in opposite directions from exchange at center. Each loop may serve up to 10 stations (of which three are shown), all equipped both to transmit and receive carriers. A carrier may be dispatched from any station to any other station; one example is pictured. System has advantages of dispensing with separate tubes from each station to central point, and of requiring fewer operators.

METAL FINGERS touch contact rings of carrier and "sense" its intended destination, just before it reaches exchange, as seen through window cut in tube of demonstration setup.

"SWITCHES" OF EXCHANGE, responding to "sensing" device, automatically guide carrier into correct outgoing tube (toward right in this case). Transparent model shows action.





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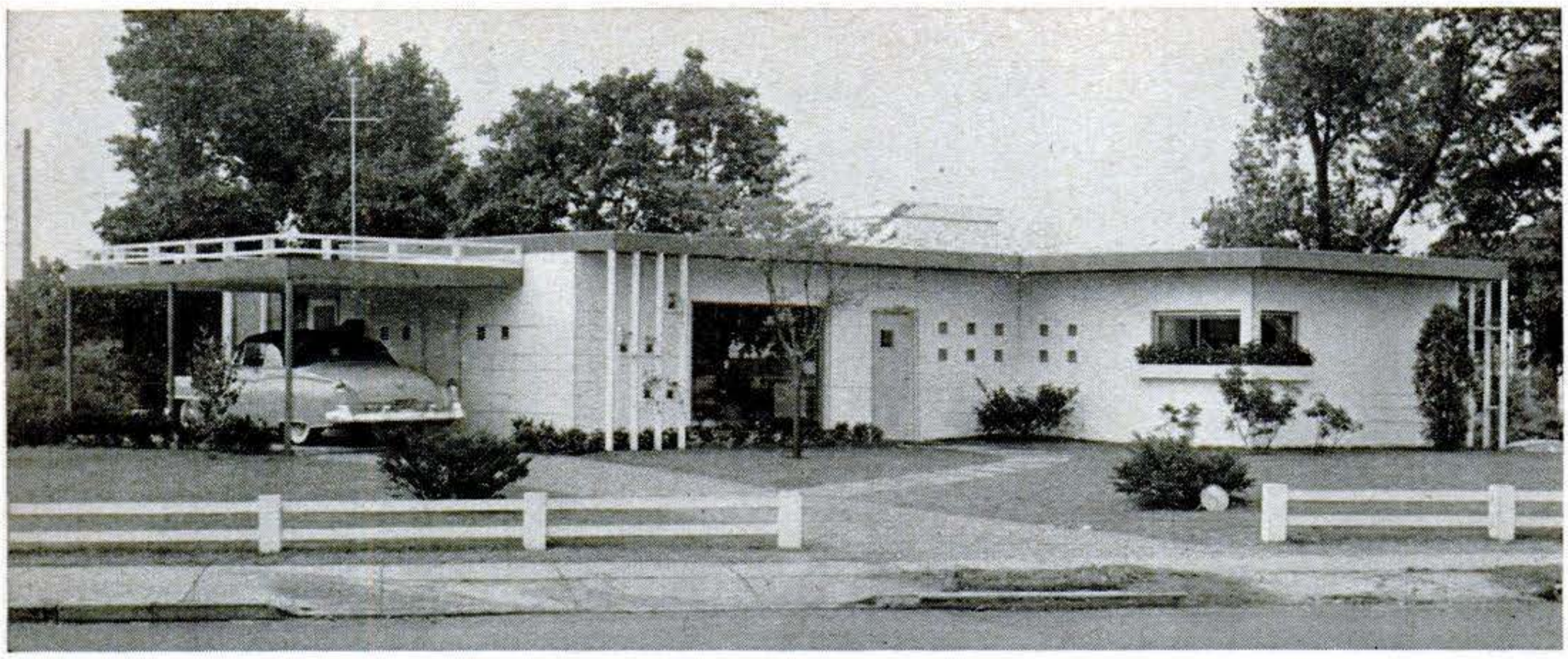


Vita house has carport; vanishing living-room window, center; three-bedroom wing, right.

Furnace in Roof Pond Heats $12,000 House

LAWRENCE VITA, of New York City, is a builder. He is also an inventor and a showman. He demonstrated all these qualities—particularly the last—when he hired six untrained girls to build a demonstration house on Long Island, N. Y., to show how easy it is to put up cinder-block walls with his patented mortar gun.

But the inventiveness of Vita goes beyond that. Visitors to the house found:

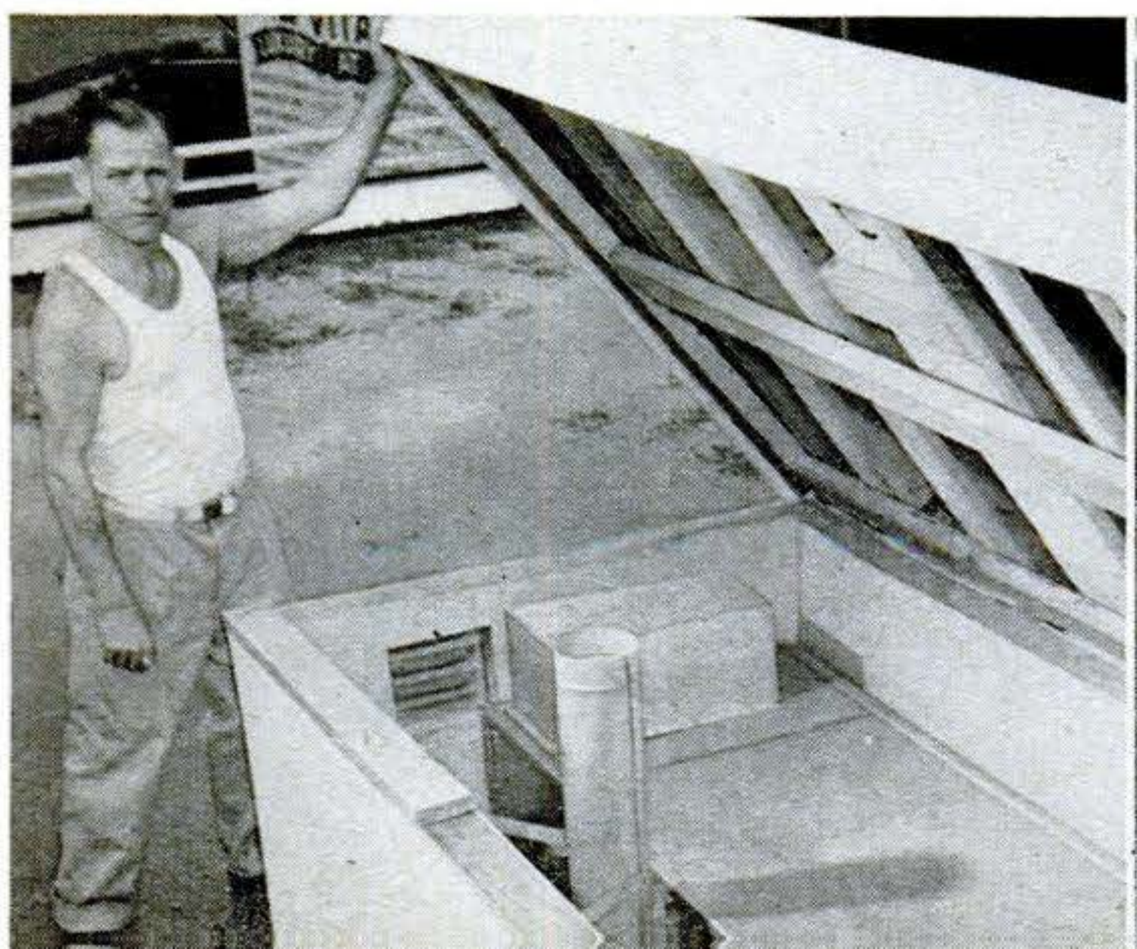
- The furnace is on an island in a pond.
- The pond is on the roof.
- The porch roof is translucent plastic.
- To open the picture window or porch door, you press a button and it disappears into the floor.

These novel features are more than attention getters. Vita's design aims at economical and simple construction plus minimum maintenance. The pond on the roof insulates against the sun's rays. The plastic porch roof lets light into the room next to it, but is sturdy and easy to install.

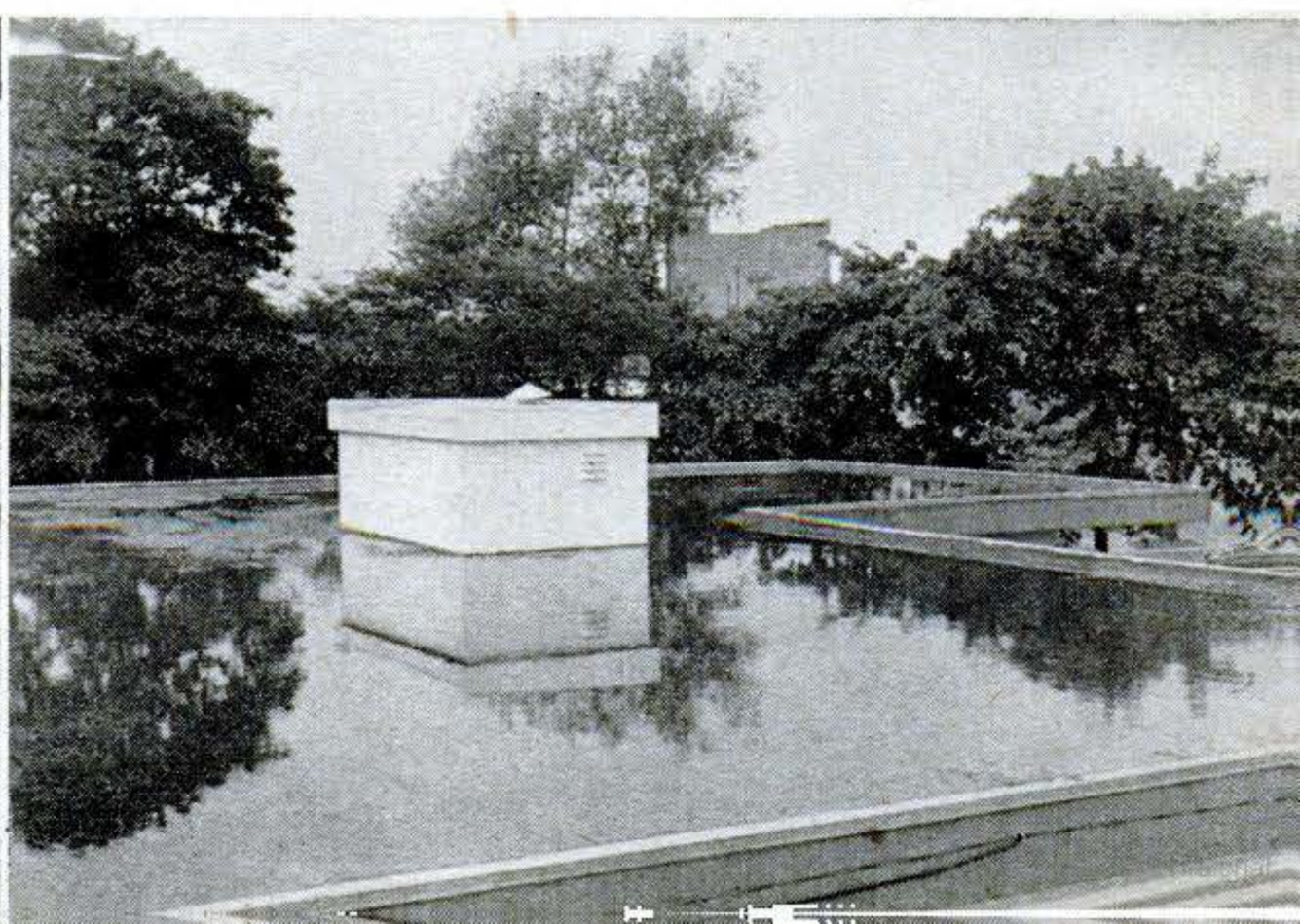
Vita is licensing contractors to build his house on a buyer's land for about $12,000. If you want to try to build it yourself, you can buy the plans for $25.

The base slab uses another Vita product —Vitacrete binder. This makes a strong concrete with air spaces forming an insulating honeycomb. It resists cracking and capillary action and blocks condensation.

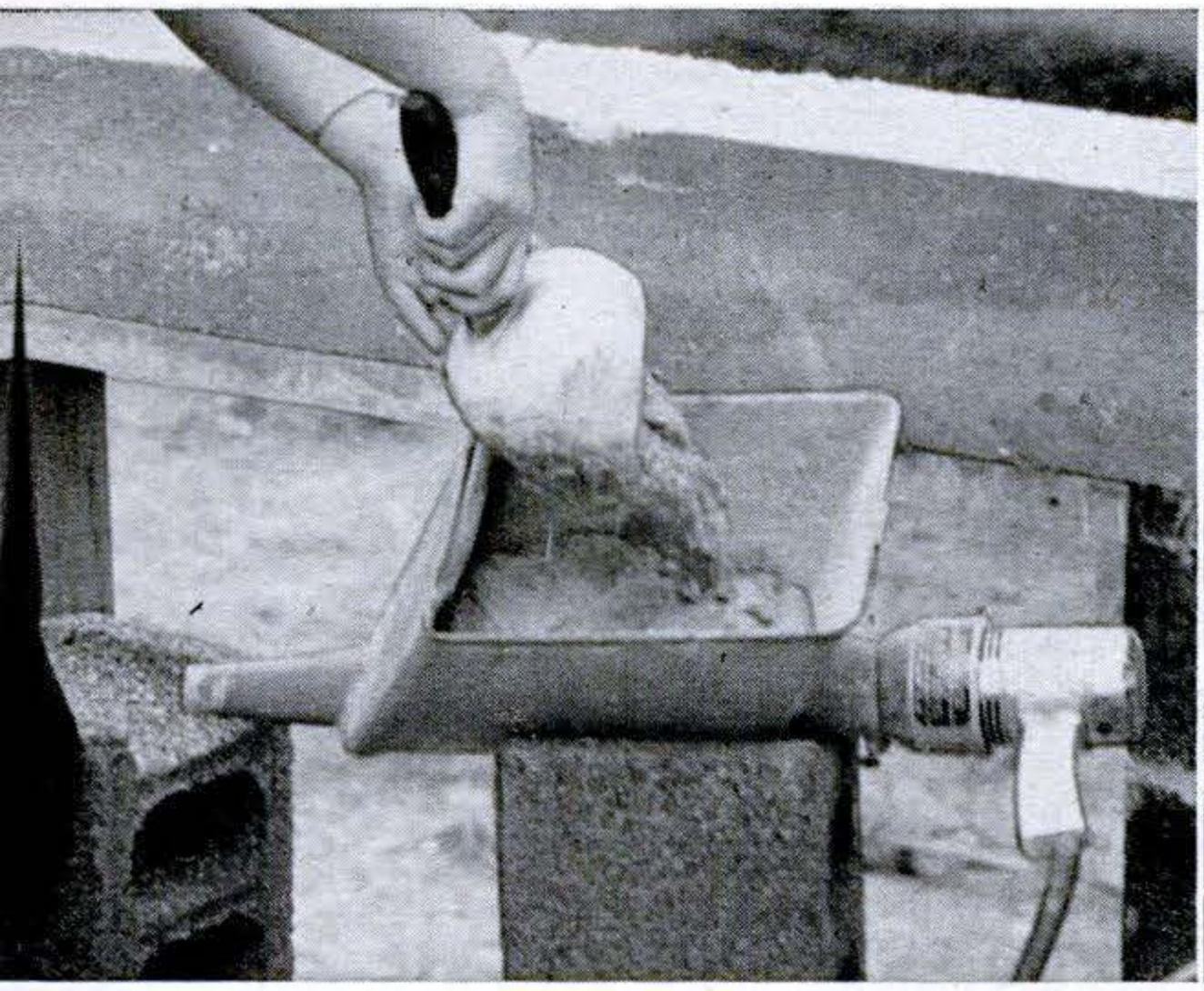
MASTER-KRAFT OIL FURNACE, in wooden box on roof, is easily installed, vents directly outdoors, needs no chimney. Fuel tank is buried. Hot air is blown into rooms below.



ROOF CAN BE FLOODED in hot weather. Sun's rays then vaporize water, instead of heating house. Roof drains through pipes within house, eliminating gutters and downspouts.



THE AUTOMATIC WINDOW is raised or lowered by electric motor. Here it closes opening into screened porch, which is roofed by translucent Corrulux plastic sheets. Glass is double-paned for insulation. Similar picture window across living room permits cross ventilation, has screen fastened to upper edge of glass. Hand-worked windows in bedrooms also have built-in roll screens. Window units can be bought separately for any house.



THIS MORTAR GUN (PS, Oct. '50, p. 153), electric powered, pushes mix out in steady stream. Here it's being filled. Vita says amateur with gun does better than pro without.

SIX UNTRAINED GIRLS, hired to build demonstration-house walls, did job in five days. Walls were later faced with stucco containing marble dust, said never to need paint.

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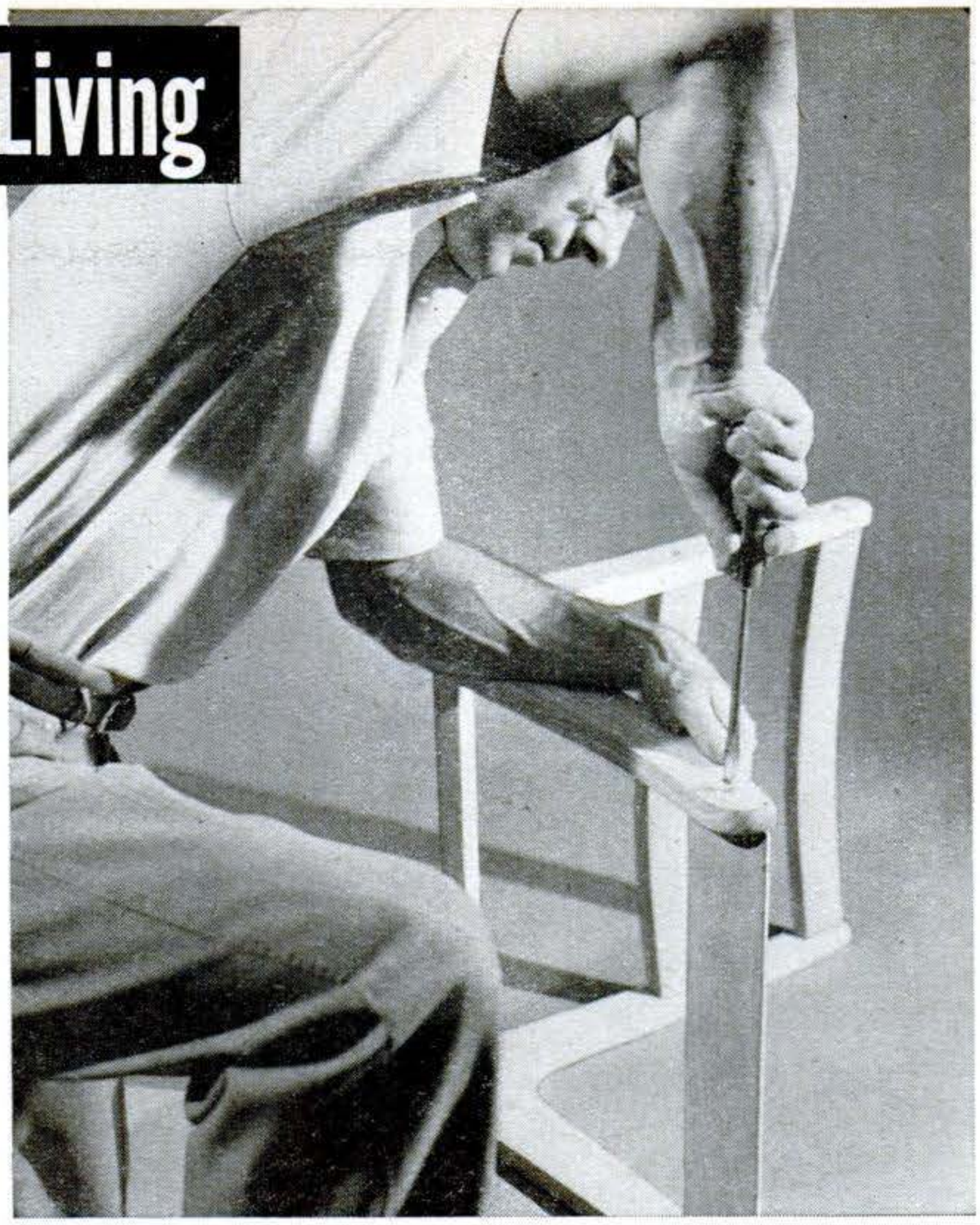
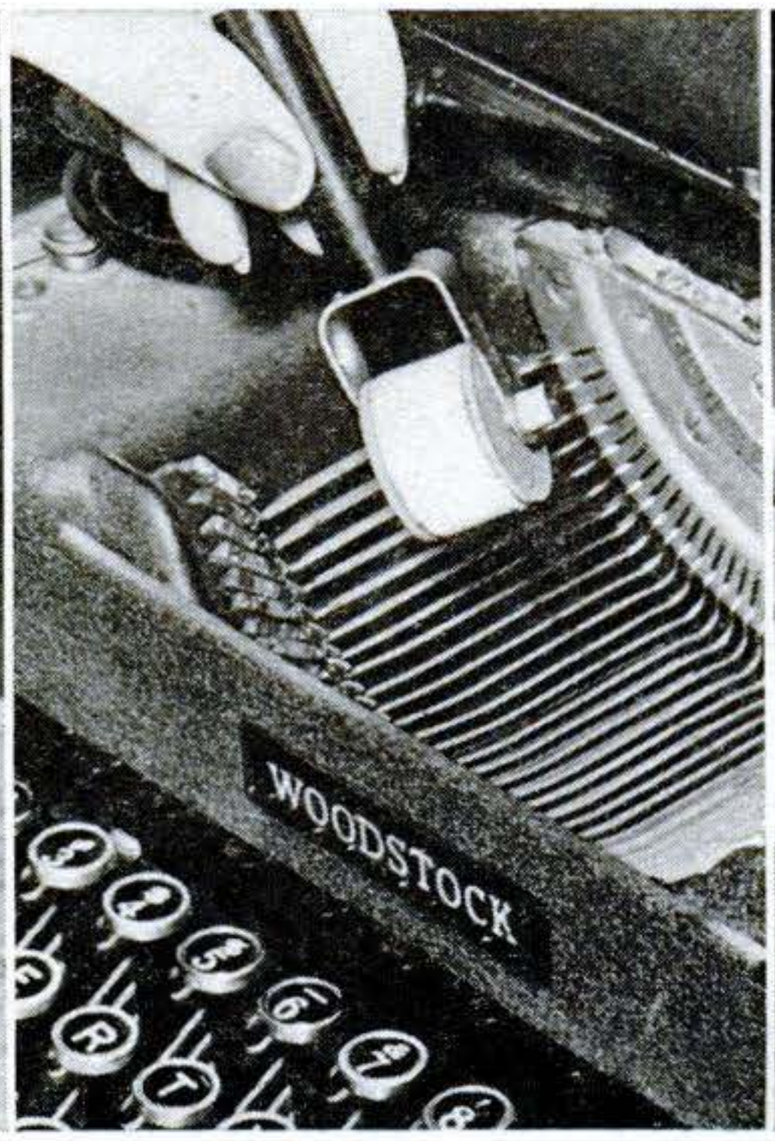
Aids to Modern Living



Prefab Chair. You can put this chair together quickly with just a screwdriver. It comes sanded and drilled, with main joint glued. *Calfab, San Gabriel, Calif.*

Laundry Bag. Both hands are free when wash is carried in this plastic bag slung over the shoulder—and there's no lifting an awkward basket or stooping to pick up each piece of laundry to be hung. *Lewis & Conger, New York City.*



Type Cleaner. When this tool is rolled over the type faces on your typewriter, a thick layer of adhesive cleaning compound picks up ink, dirt and stencil wax. A few licks daily will keep the type clean. *Pan-Amerco, Inc., Cleveland.*

Plant Tender. Put one of these funnel-shaped cups in the flowerpot, fill it with water and you can go off for a week without worrying about the begonia. Water seeps through cotton in spout to plant. *Miles Kimball Co., Oshkosh, Wis.*

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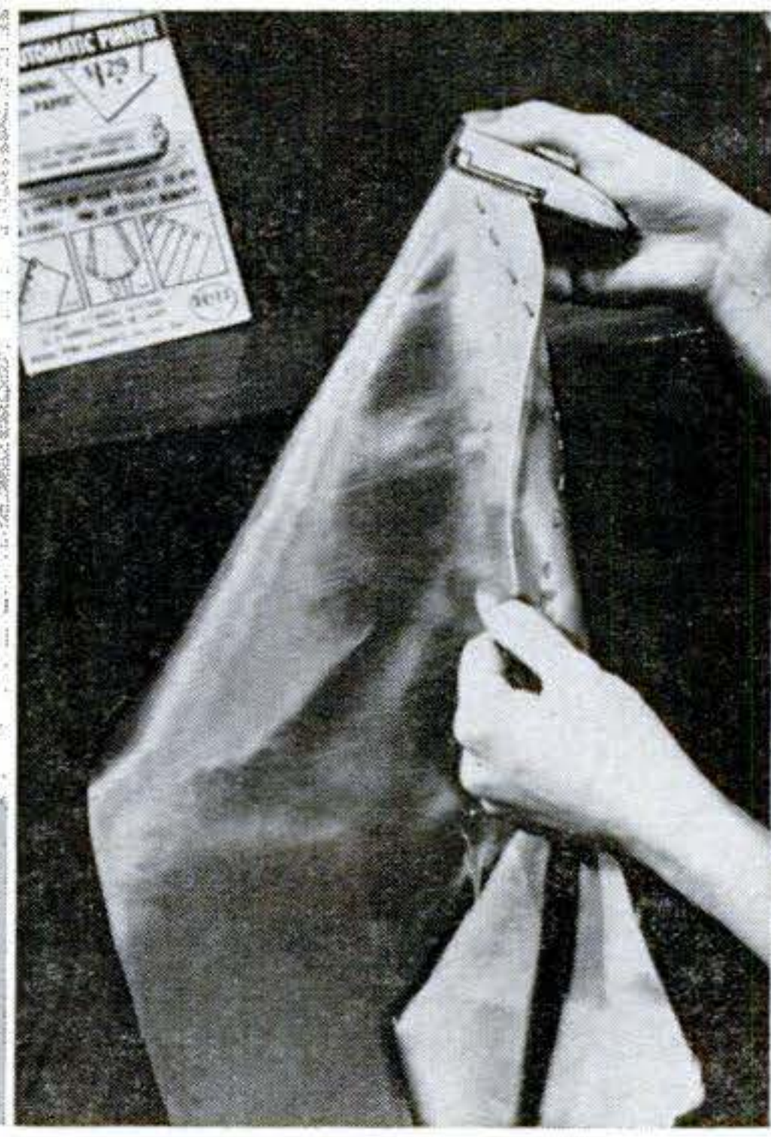
Kitchen-in-a-Cabinet. Sink, stove, refrigerator and storage bin are combined in this one unit. The cover for the stove—gas or electric—serves as the sink drainboard. *General Air Conditioning Corp., Los Angeles.*

Ironing Board on Wheels. This board rolls away for storage. Adjustable from 27 to 36 inches in height, it has off-center legs for sit-down ironing. Brakes lock the wheels. *Proctor Electric Co., Philadelphia.*

Swivel-Top Cleaner. An eight-foot extension hose on a rotating cap swings all around this vacuum. A housewife can clean an average-size room from a central point, without moving the tank. *General Electric Co., Bridgeport, Conn.*



Sewing Aid. Hems can be pinned up or seams put together with this automatic pinner, eliminating basting. Pressure on the dispenser feeds headless pins, pointed at both ends, through the cloth. *John Dritz & Sons, New York City.*

Musical Suitcase. Carry a traveling case with a built-in radio and you can have music wherever you go. It has enough space for overnight essentials. Come summer, it will hold a picnic lunch or beach duds. *Electron Enterprises, Berwyn, Ill.*

Please turn the page for more aids to modern living.

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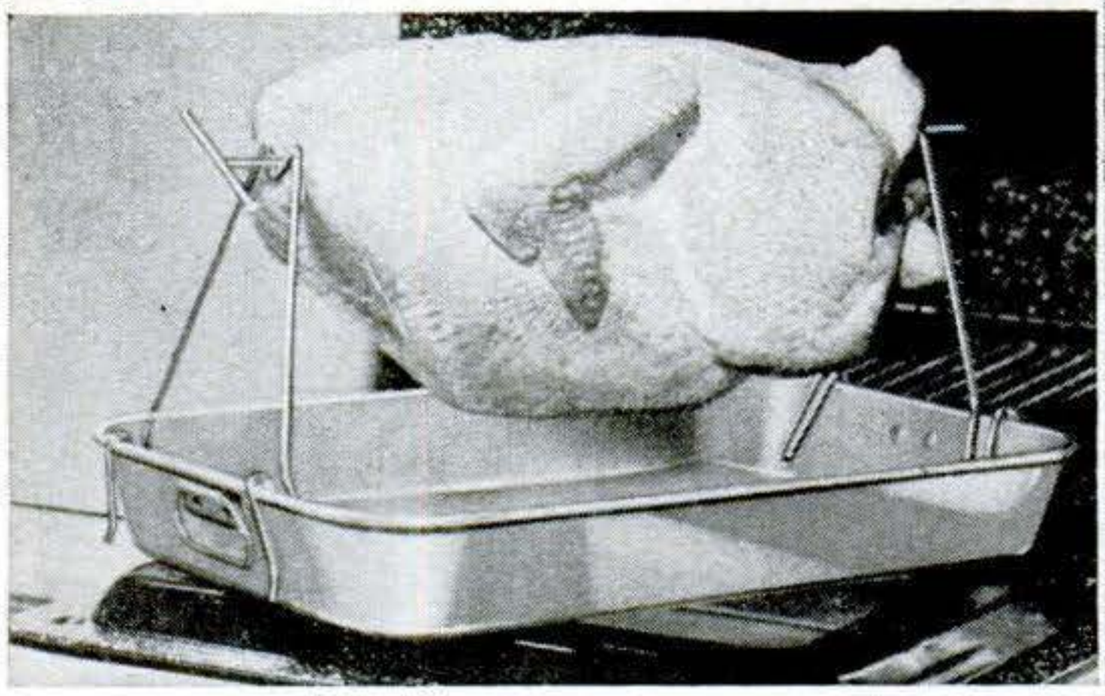
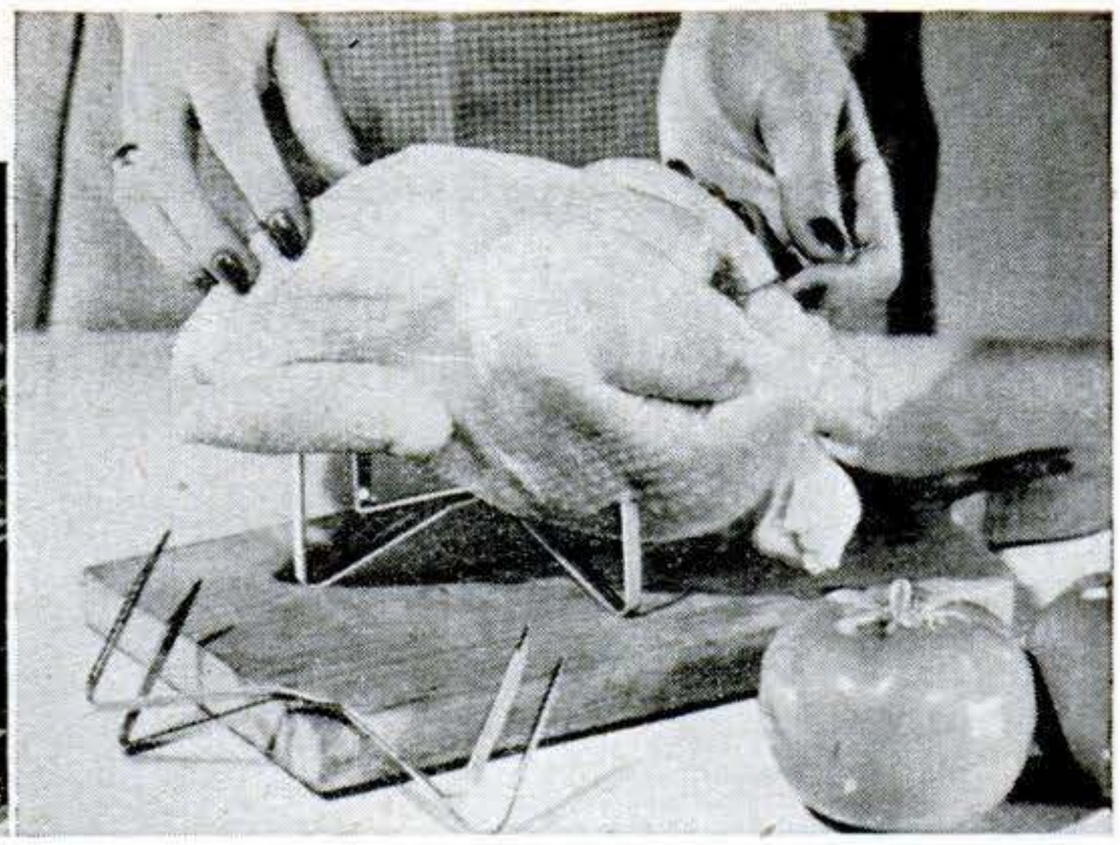
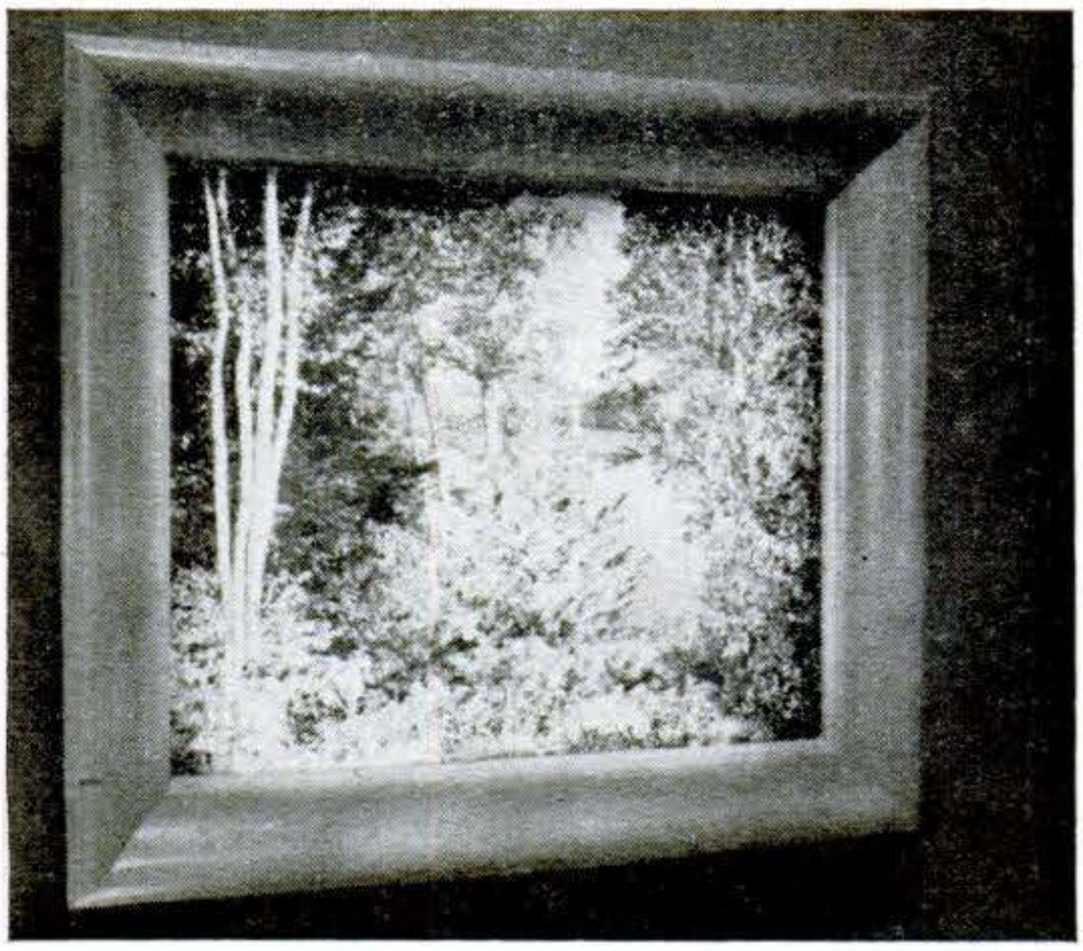
MORE Aids to Modern Living



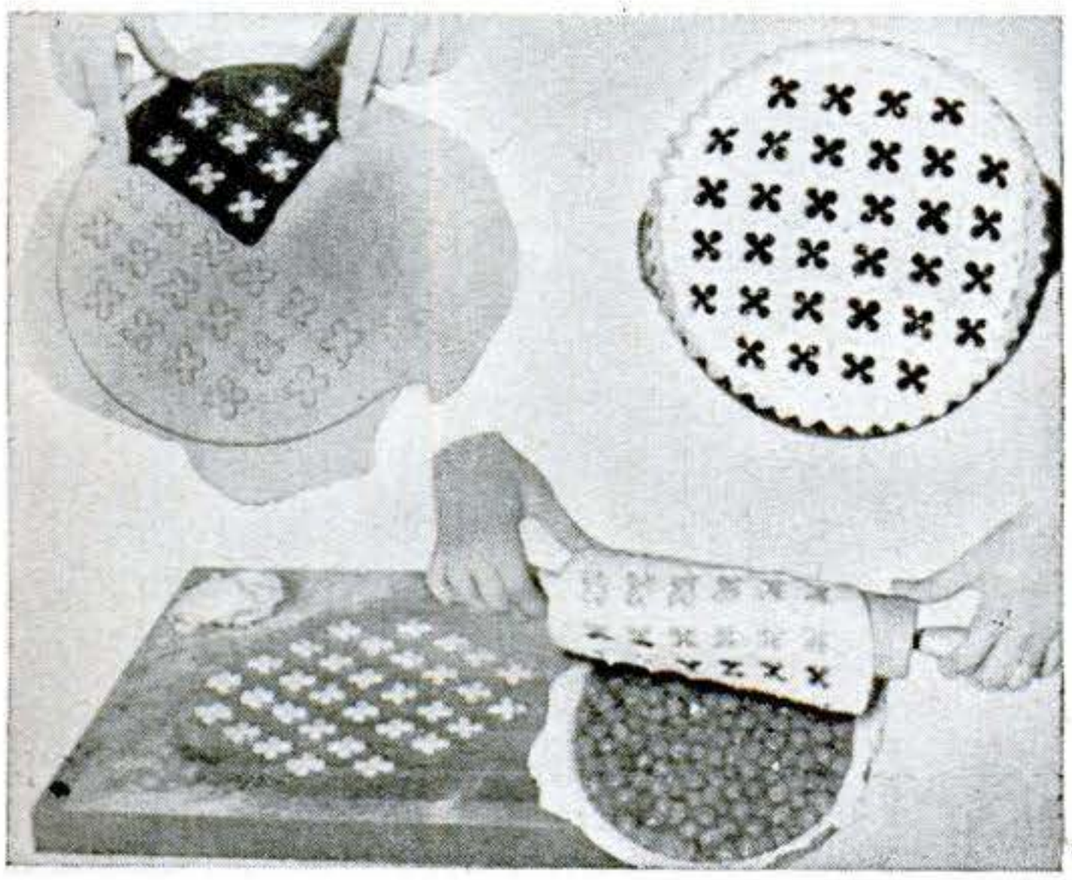


Roast Racks. A fowl or roast impaled on one of these racks is kept above grease and cooks evenly all over with less shrinkage. Rack at left above, from Albin of California, Los Angeles, Calif., converts any rectangular pan into an oven barbecue. Rack at right, from Arnold Industries, Toledo, will also hold cooked fowl in proper carving position.



Back-Lighted Pictures. Colored pictures on translucent plastic sheets have a three-dimensional effect when illuminated by fluorescent lights concealed in the frames. *Helms Products, Inc., Grand Rapids, Mich.*

Pleating Tape. With the tape above sewn to the tops of drapes, box or pinch pleats can be made in a jiffy and with less material. Metal clips are inserted in pockets in the tape in different combinations to form the pleats desired. *Joseph Rental, New York City.*



Pie-Cover Cutter. Openwork tops for pies are prepared quickly with this plastic cutter that stamps a clover design in the dough. Carving out a quarter-circle at a time, it cuts the outer dough edge as well. Three pins position the cutter for the next stamping. *Kesco, Chicago.*

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Inventor Bert Benander and panel beside him display some of 60-odd gadgets he has created.

He Has 60 Patents On Money-Makers

Though they haven't made the headlines, Bert Benander's inventions show how ideas can ring the cash register.

By L. B. White

MANY a young inventor says to himself every day, as he putters lovingly with some gadget in a basement workshop, "Sure wish a guy could do this for a *living!*" And too many a skeptical friend squelches that pleasant daydream with a caustic, "This is the Twentieth Century, Mr. Edison Ford Junior! Even if you came up with something as revolutionary as the electric light or the automobile, you'd have to find a couple of millionaires to back you."

Bert Benander, 50-year-old son of an immigrant iron-molder, has neither invented page-one sensations nor buttonholed millionaires, but he has made a mighty good living by inventing electrical household gimmicks.

He quit high school after two years to earn $8.25 a week—and now has more than 60 patents, a coveted Charles A. Coffin Award (shared with his brother), a rambling 1790 farmhouse set in 70 hilltop acres 15 minutes from downtown Providence, R. I. —and, the admiring devotion of 1,500 fellow employees of the General Electric Co.

This is the story of how he became engineering manager of GE's Monowatt Department, which makes wiring devices and

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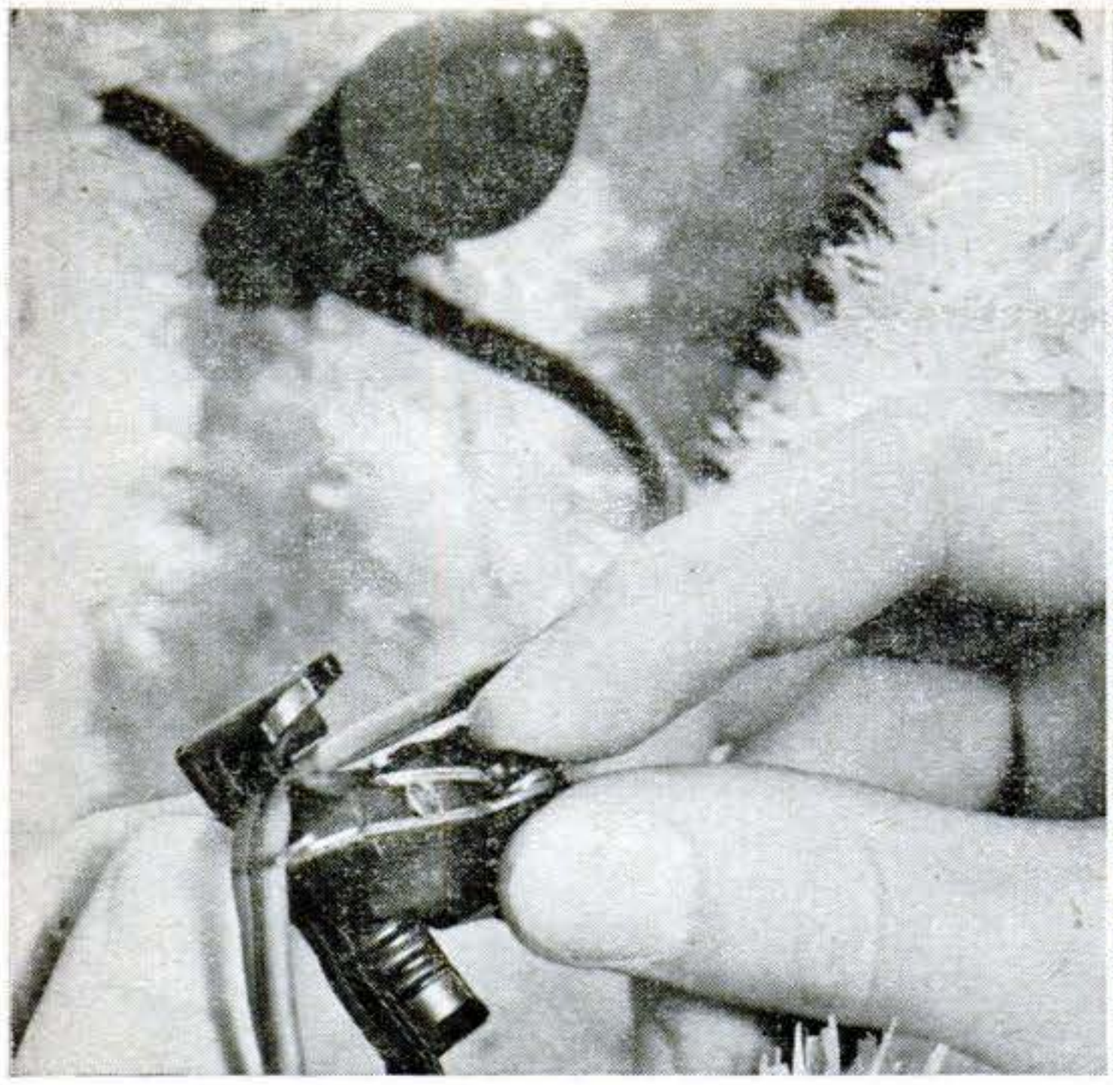
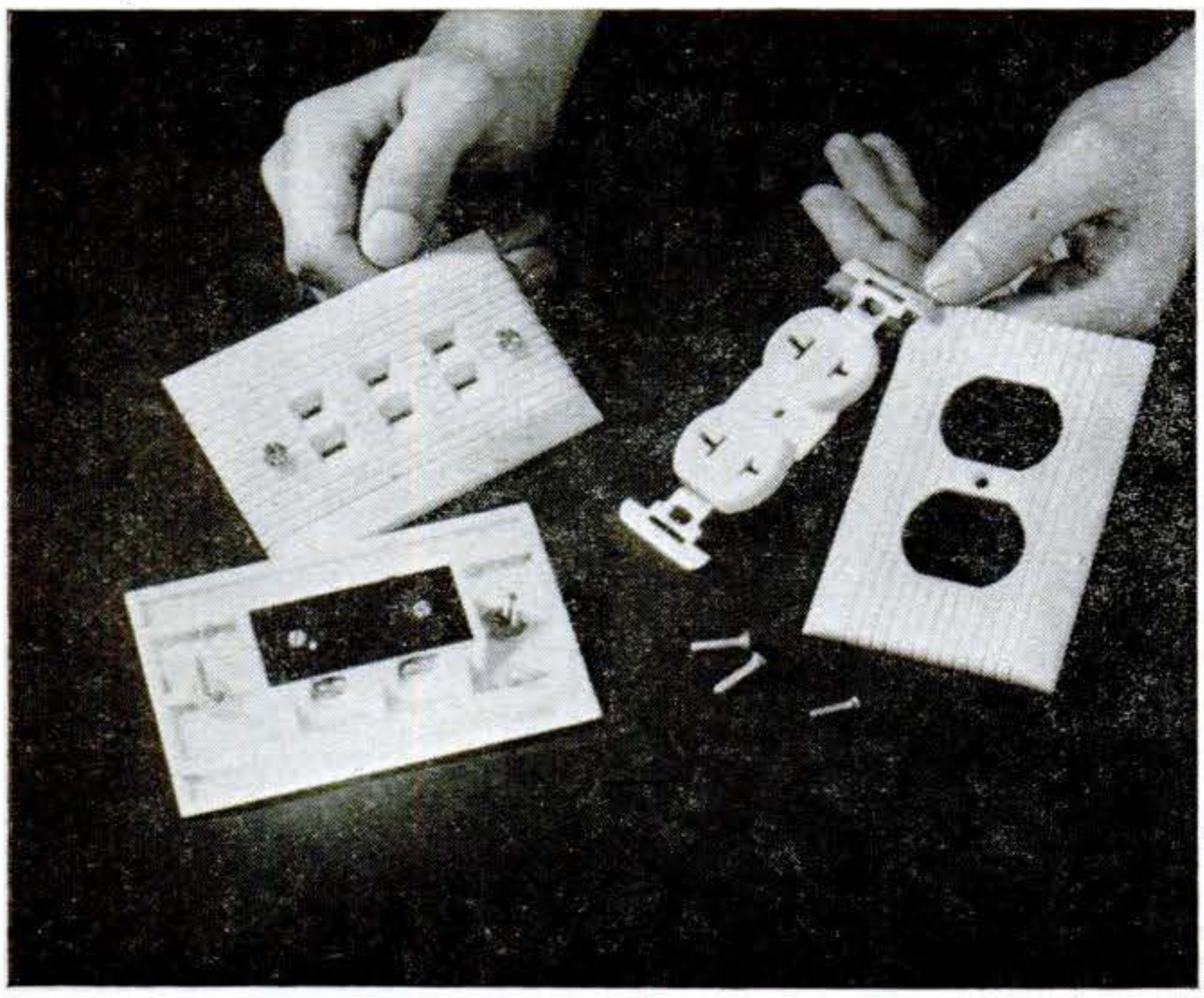


CHRISTMAS-TREE SOCKET that clamps anywhere on cord (above) is one of Benander's handy inventions. At right he demonstrates, with miniature tree, how you can use it to arrange lights just where you want them. Sharp points penetrate insulation of cord to make contact.

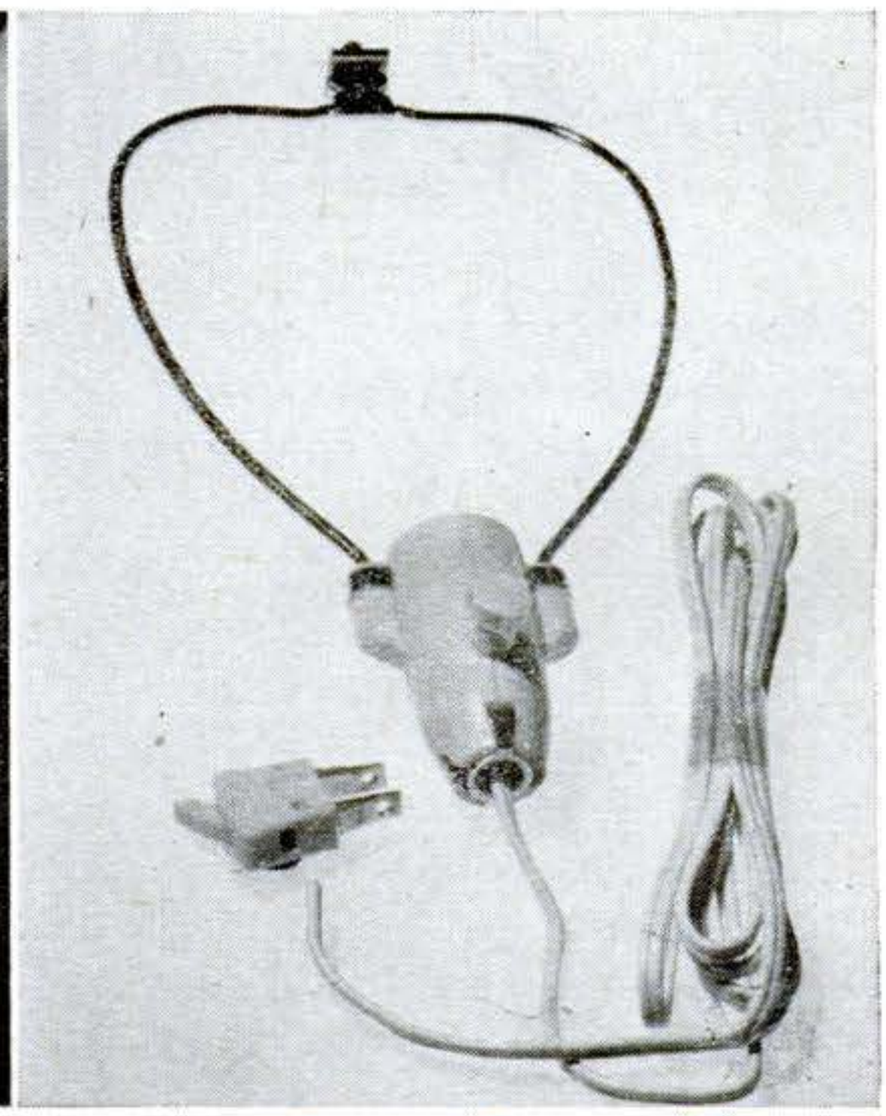
other "small electrics." But Bert Benander emphasizes that any boy who ever showed an aptitude for putting together such things as humming-bird kites, home telephone sets and midget autos, "can do what I've done."

George Berthel Benander's parents came to Connecticut from Sweden in a ship that was neither very big nor very stylish. In the American tradition, Bert got a sound public school education—for 10 years. Then, just before World War I, money became tight in Meriden, Conn. Brother Clifford had to be educated, too. So Papa Benander told Bert he'd have to go to work.

A friend got the willing 15-year-old boy on as timekeeper for the Connecticut Telephone & Electric Company, at 15 cents an hour. Then Bert got the draftsmen to show him how to trace nuts and screws and do cutaways and projections. In 1917, he became a full-fledged apprentice draftsman. Then Colt, which had taken over a plant in Meriden to turn out Browning machine guns, offered him $12 a week. Bert jumped



PLASTIC WALL PLATES of multiple outlets, kept intact as above when used singly, are grooved near edges. To join several plates in compact group, you can break off ½-in. strips cleanly.



IMPROV-A-LITE KIT adapts ordinary table lamp, or one you've made from a bottle or vase, to use three-intensity bulb. To attach Quick Clamp plug, just insert cord and press lever.

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ROTARY PLASTIC MOLDING MACHINE won Bert Benander (in photo), and a brother, GE's highest honor. Powdered plastic goes in—and out come 30 to 60 electric gadgets per minute.

at it. After a year, one of Colt's tool designers went to Aeolian, which made phonograph motors and records, and took Bert along.

Few people remember it now, but there was a serious depression in 1921. Bert Benander was let out and had to go back to his old job as timekeeper at ConnTel.

That setback didn't sour Bert. ConnTel was becoming interested in molded plastics for electrical sockets, switches and other attachments. And Benander was soon in the Tool & Mold Design Department, superintending the design of molds for the cold pressure-molding of pitch and asbestos and the 36-hour baking of the finished parts.

Trouble Is His Business

The bulk of these parts went to other industrial concerns, which often furnished hazy specifications. So Bert asked to be transferred to the Sales Department, and spent five years on the road trouble-shooting the specifications.

Eventually, someone at the Monowatt Electric Import Company, makers of wiring sets in New York City, noticed Bert's genius as a trouble-shooter. Monowatt had some design problems, and Benander left the road to solve them. The company was purchased by the Miller Company of Meriden, makers of lamps and fixtures. So Bert, as Monowatt's one-man engineering department, went back to his home town. GE bought Monowatt in 1929, moved it to Bridgeport and then to Rhode Island.

1,500 First Names

You have to be nimble to tour the far-flung Rhode Island works on Bert Benander's heels now. Fortunately, he pauses along the way to call every one of 1,100 Providence and 400 Newport employees by his or her (70 percent are women) first name. That makes an interesting introduction to Benander gadgets: there are ways and ways of acknowledging a boss's greetings; Monowatt's 1,500 faces light up like the Christmas trees its clip-on-anywhere light sockets adorn.

You can inspect the gadgets yourselves at many electrical, and hardware stores. The

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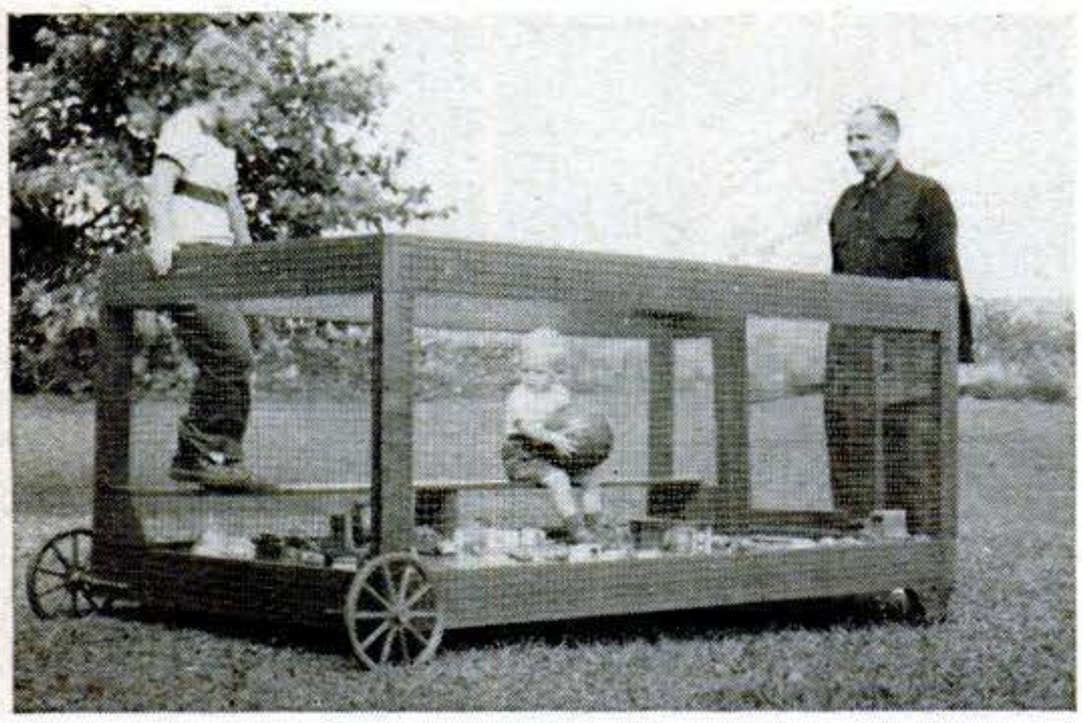
new Christmas-tree socket held me up for 15 minutes. Separate from the cord, to which it can be clamped in any position after the tree is strung, it has sharp points that penetrate the cord's insulation and make contact with the metal wires inside. It solves a spacing problem that has bedeviled every tree decorator who has ever tangled with the fixed-lamp sets.

Benander Quick Clamp plugs and connectors do away forever with peeling wire ends with a penknife and laboriously winding them about tiny screws. Just insert the unpeeled cord and press a clamp down—pointed prongs pierce the insulation and make the connection.

Newest thing as of the fall of 1951 is



MOBILE PLAY PEN of wood planks and heavy-duty fence wire, built by Benander for his grandson Stevie, has wheels and handles so it can be trundled about like a wheelbarrow.

the Improv-A-Lite, a kit that modernizes ordinary table lamps by adapting them to use three-way bulbs of variable 50-to-150-watt intensity.

And there are whole lines of magic all-in-one, outdoor-indoor surface wiring units, extension cords, sectional wall plates that can be broken off with the fingers to fit any space, detachable plastic sockets and ceiling fixtures, silent switches, lamp holders, current taps, bells, transformers, fuses and fittings of every description.

Plastics Molder Wins Award

When electrical wiring and plastics began to "go steady" a couple of decades ago, Bert Benander was one of the principal matchmakers. And his crowning achievement (in collaboration with brother Clifford, Monowatt's manufacturing engineer) was a shop-designed, Benander-conceived-and-built machine to mold the plastic parts in a matter of seconds. More than a score of these machines are now operating at Monowatt and in other GE plants. The Coffin Award that the Benander brothers received for this device is GE's highest honor.

"How about this farm of yours?" you ask, pretty certain that home and family go a long way to explain the man's popularity, his ability to work under pressure without showing strain—in short, his character.

Invents Even at Home

"Like to see it?" he says, his blue eyes glowing like the "ready" signals on his molding machine. "I'll drive you out."

You swing off the highway nine miles south of town and sweep up a broad, well manicured hilltop lawn before the big white building that begins on the left with the original farmhouse and extends for a hundred or more feet into a succession of connected smaller buildings toward a barn.

How did he ever manage to keep all that lawn (maybe two-three acres of it) cut so trimly?

"Oh, we built us a little tractor out of an

POWER MOWER contrived by Benander tends his three-acre lawn. He shortened front axle of Model A Ford, used old Plymouth clutch and arranged mowers to cut triple swath.

old Model A and some stuff we had lying around. Body's a piece of channel iron. Powers three mowers. We built a bigger one out of a Model A truck: has a snowplow."

He tells it all with the breathless excitement of a kid with a new toy.

"Used to play a lot of golf," he explains. "But this place . . ." He reaches down to give a homemade merry-go-round fashioned out of a wagon wheel an absent-minded twirl. "Just look at that stone terrace: I'm about four weeks behind on it." END

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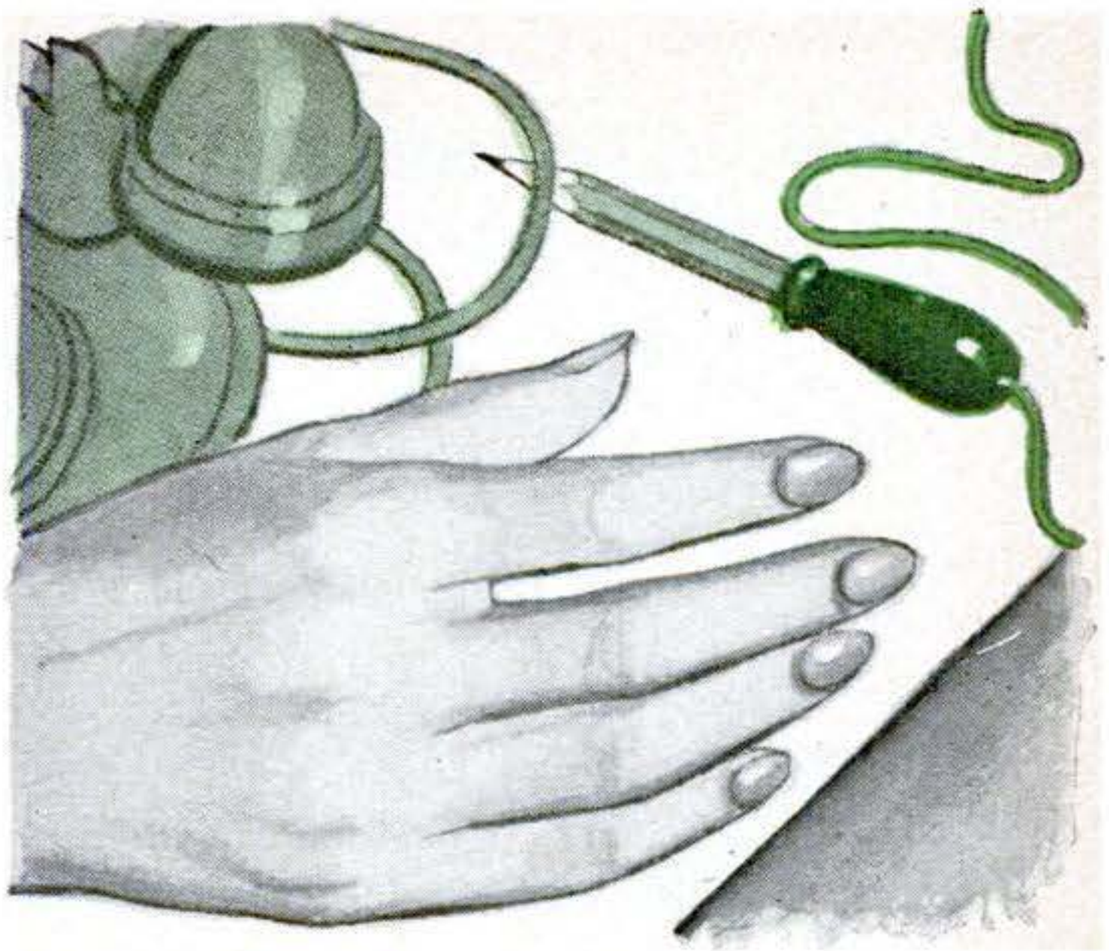
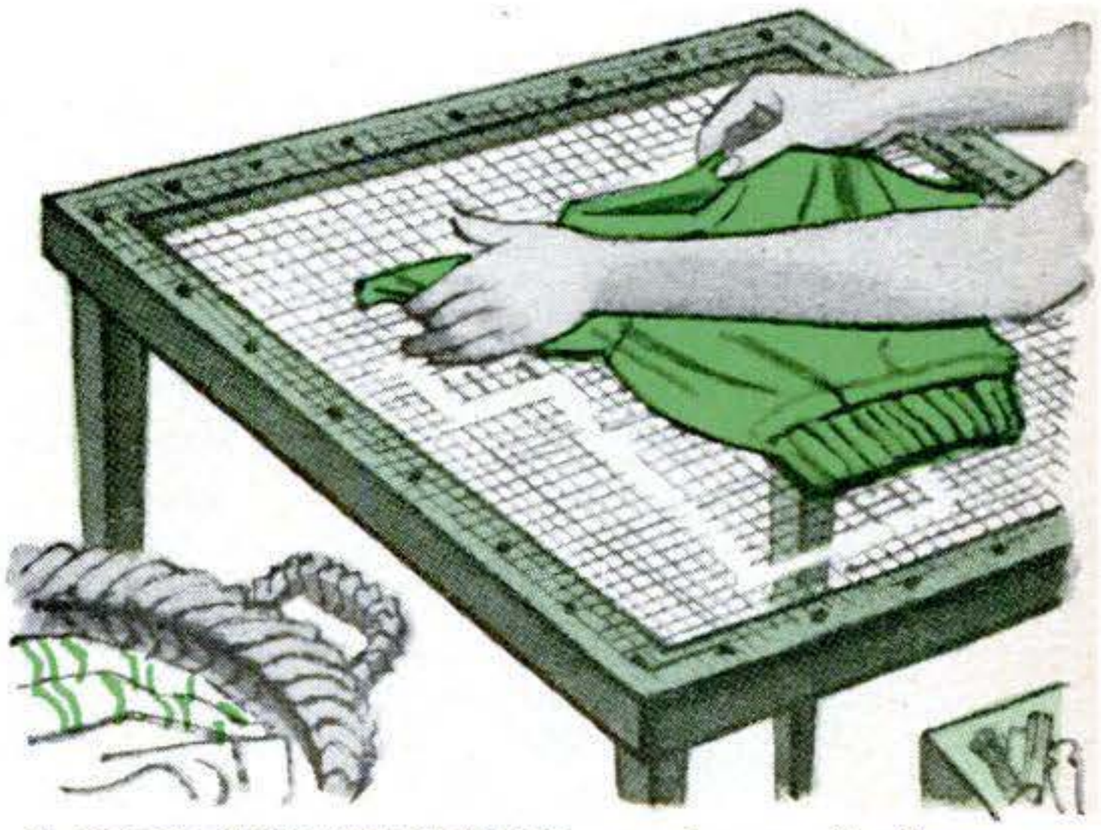
Keeping the Home Shipshape

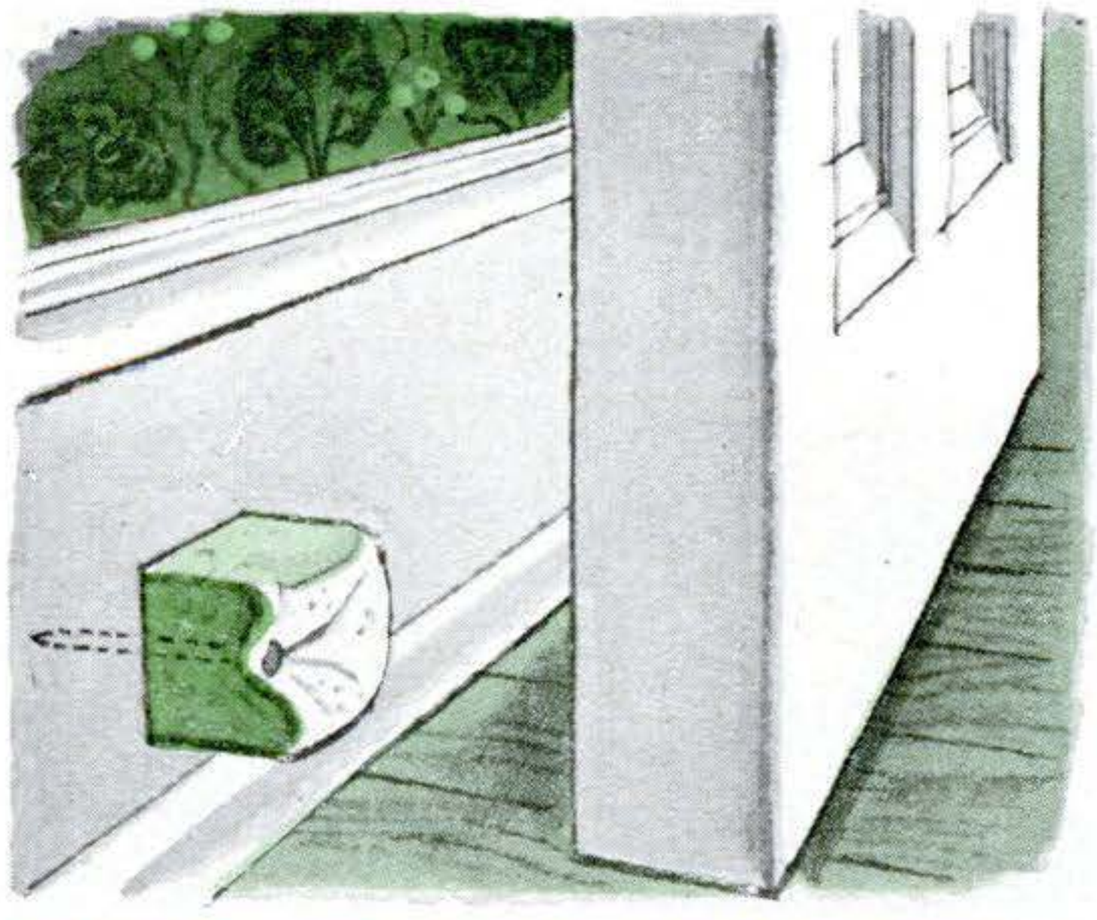


FIT A PENCIL with a medicine-dropper bulb that has been threaded with cord, and you can keep it handy on a hook near telephone or workbench.

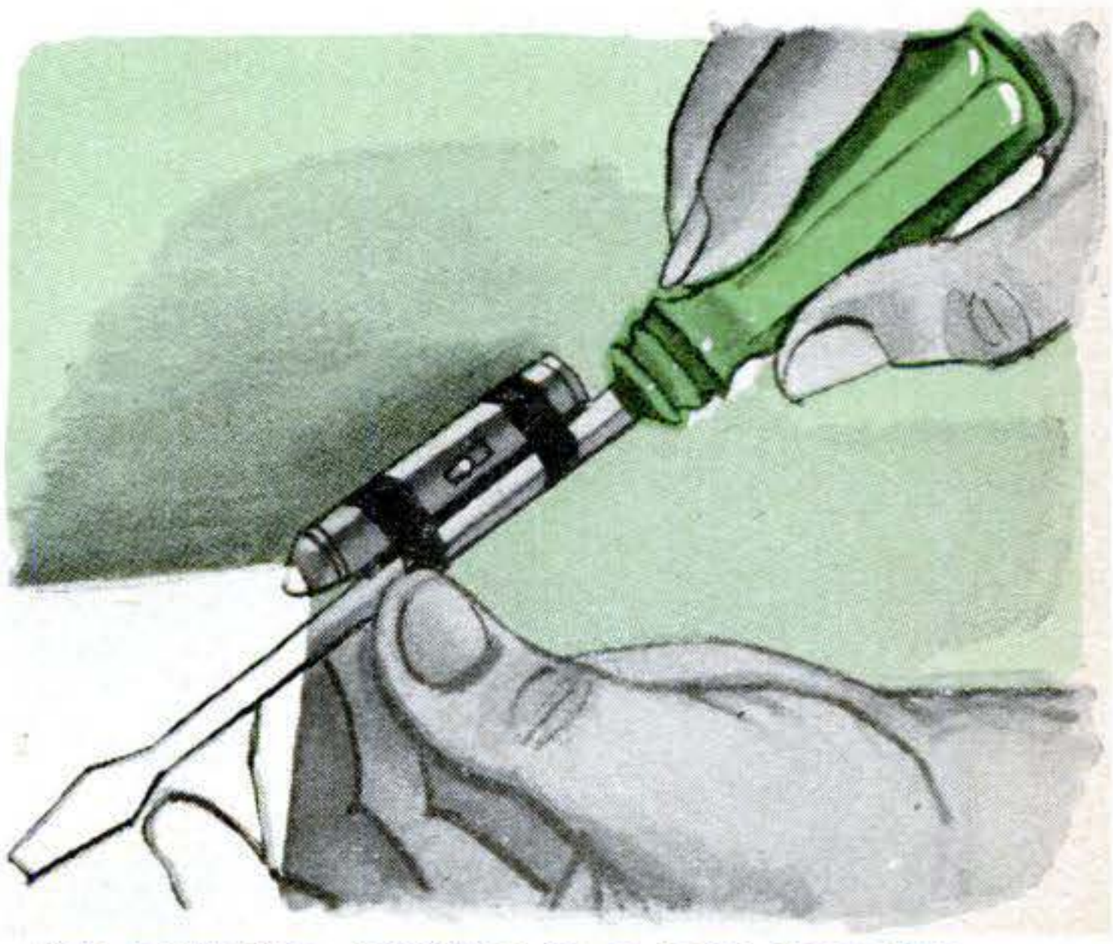
CHRISTMAS WINDOWS of "stained glass" are just ordinary screens covered with white cloth. Bits of colored cellophane, pasted over drawings on the cloth, are joined with tape.



A GOOD SWEATER DRYER can be made from an old card table if the top is replaced with plastic screening. Outline sweater on screen with chalk, wash, stretch within marks.



SPONGE RUBBER MAKES A FINE DOOR STOP. A nail driven through the center of a 1½-inch cube compresses the rubber, but the sides remain high enough to check the door.



FOR DRIVING SCREWS IN DARK CORNERS, you can rig up a self-illuminated tool. Just tape a pen-type flashlight to the screwdriver's shank so it lights the work.

Please turn the page for five more suggestions.

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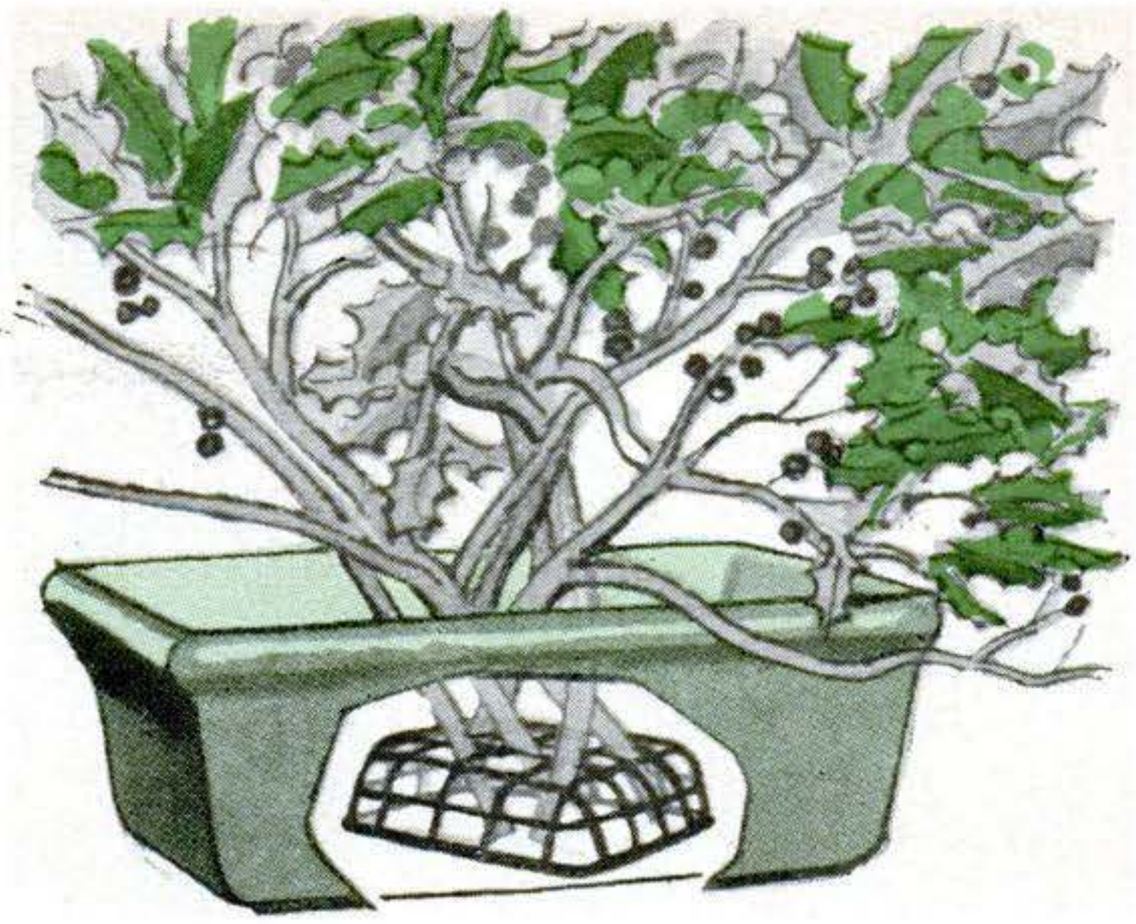
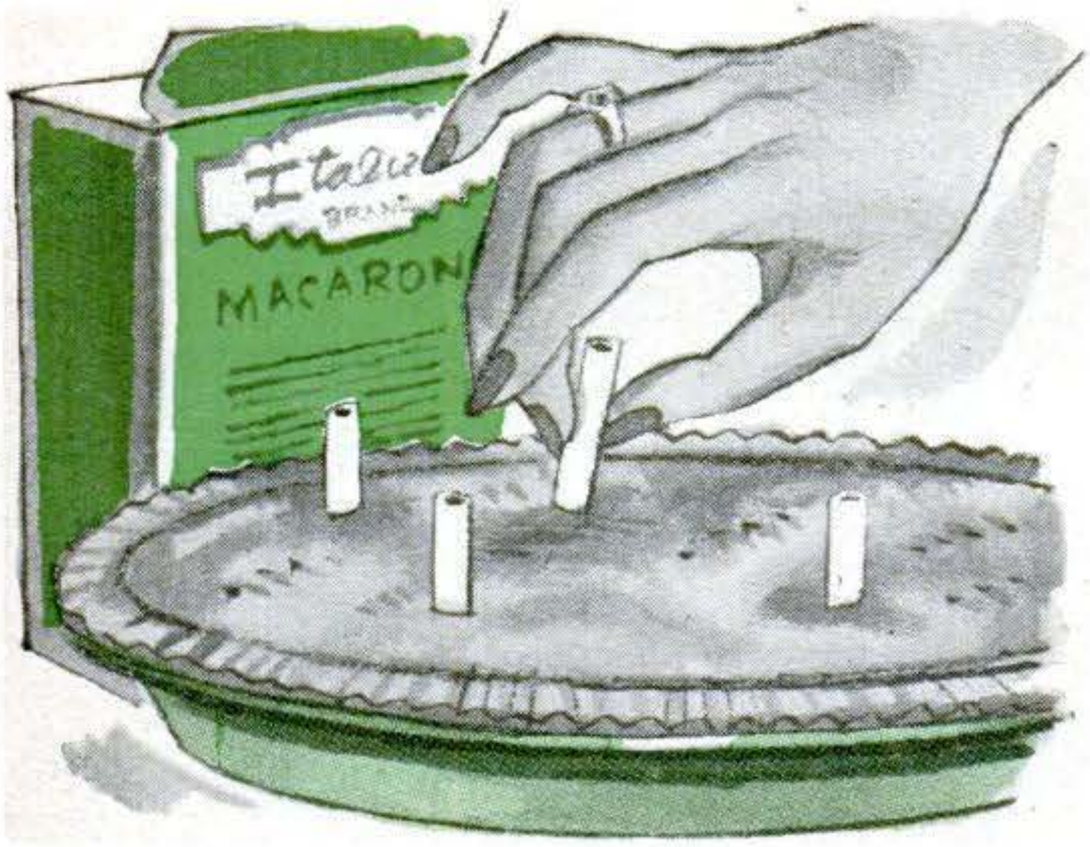
Keeping the Home Shipshape

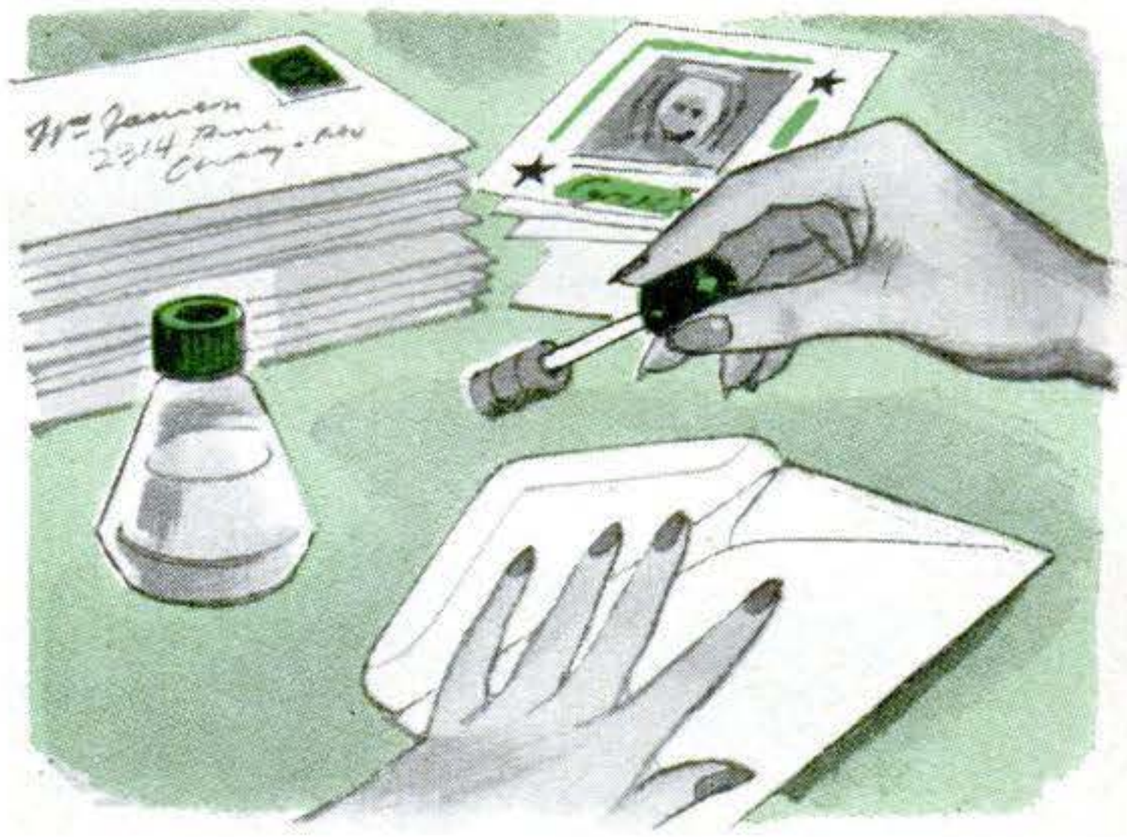
NUT MEATS ARE CHOPPED FAST with a rolling pin. They should be covered with a cloth so they won't scatter, and rolled lightly with the pin until they break to the desired size.



IN ARRANGING CHRISTMAS GREENS—holly, bittersweet or barberry—a wire soap dish will serve as a large-size frog. Upended, it holds the heavy branches securely.



CHIMNEYS FOR FRUIT PIES can be made by sticking macaroni through the crust before baking. Extra fruit juices then rise up in the macaroni instead of overflowing in oven.



CHRISTMAS MAIL CAN BE SEALED IN A HURRY with a dauber formed by wrapping flannel around a discarded nail-polish brush. The polish bottle can hold water for moistening.

IF YOUR LINOLEUM IS WORN in front of the sink or stove, try painting a "rug" over the spot. Outline the design with chalk, fill in with paint and finish with spar varnish.

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Models Preview Future Missiles

How tomorrow's guided missiles may look is indicated by these designs from Lewis Flight Propulsion Laboratory, Cleveland. One at left above has twin ramjets on wings; other, sporting tailfirst stabilizers, has ramjet in fuselage. In the photo at right, testers ready a full-scale ramjet for a 20-mile-a-minute "flight" in the laboratory's supersonic wind tunnel.

Smaller Austin Unveiled at London Auto Show

Hit of the British Automobile Show in London this fall was the Austin Seven, which the manufacturer claims is the nearest approach yet made to a perfectly scaled-down big car. Designed primarily for the American "dollar market," the compact four-seater features an all-steel body, foam-rubber cushions front and back, four-speeds-forward synchronized transmission and conservative streamlining.

Powered by a four-cylinder, 30-horsepower, overhead-valve engine, the little sedan weighs less than 1,500 pounds, has a wheelbase of 79½ inches, cruises at 60, and can go 50 miles on a gallon.

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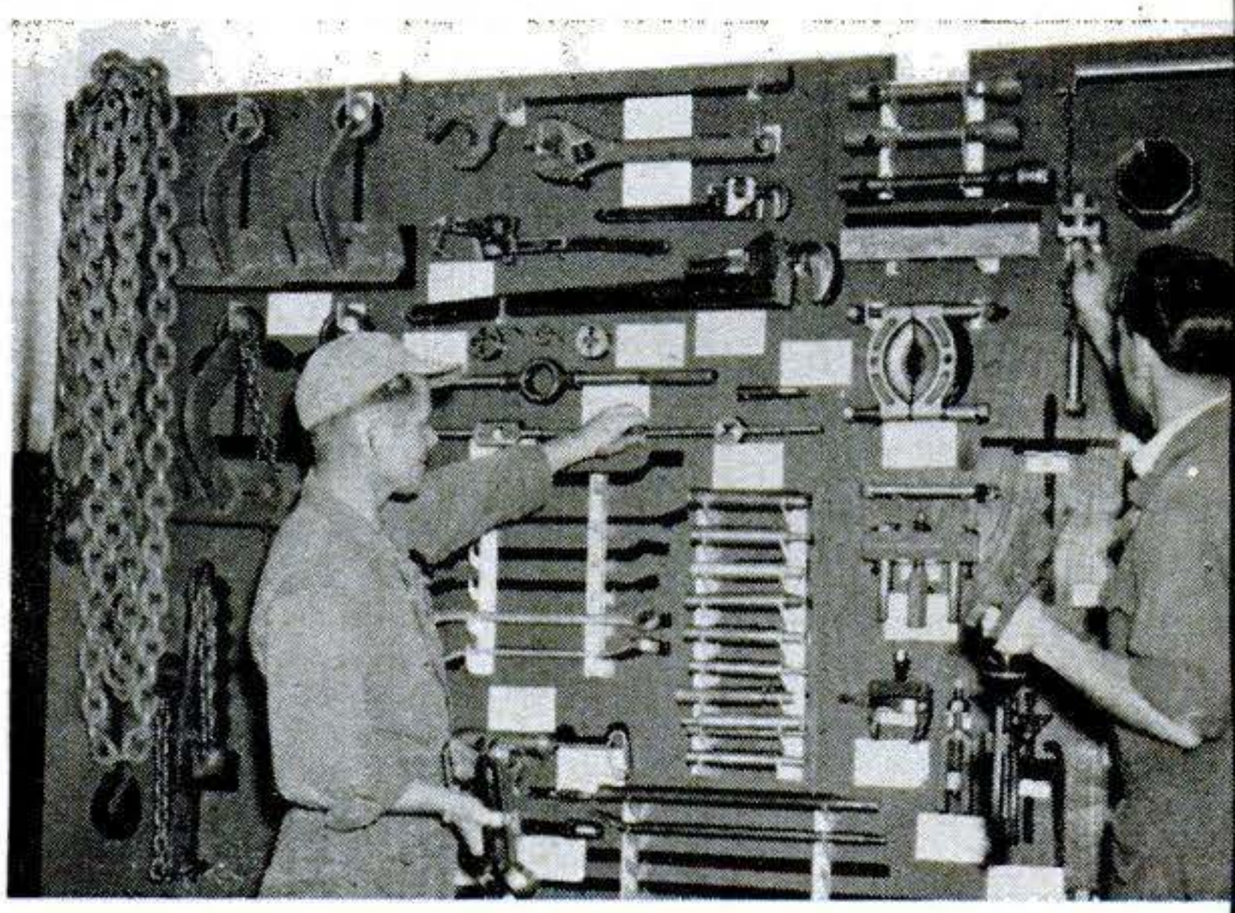
THE BRUSH AND BUCKET BRIGADE is grateful to the inventor of this contrivance. It sprays liquid soap called "gunk" onto a plane, turning a two-hour cleaning chore into a 15-minute cinch. Its anatomy consists mainly of water boilers and a discarded air compressor.

Air Force Inventors Keep 'em Flying in Europe

DO IT the easy way is the motto of these inventive GIs at the big Twelfth Air Force supply and repair depot at Erding in Bavaria, Germany. Their ingenuity saves a lot of hard labor.

A few of the gizmos the grease monkeys have dreamed up out of spare parts are illustrated here: the "gunk" machine for washing planes; a tool rack that tells which tool is gone and where it went; a contraption that times a GI driver's reflexes and chalks up the score; and a scoop carrier that takes the grunt out of manhandling heavy batteries.

Devices like these don't win wars directly, but indirectly they help step up the tempo of operations overseas as General Eisenhower builds his Atlantic Pact forces.



THE CASE OF THE DISAPPEARING DRILL is solved with tool board, built of old packing cases.

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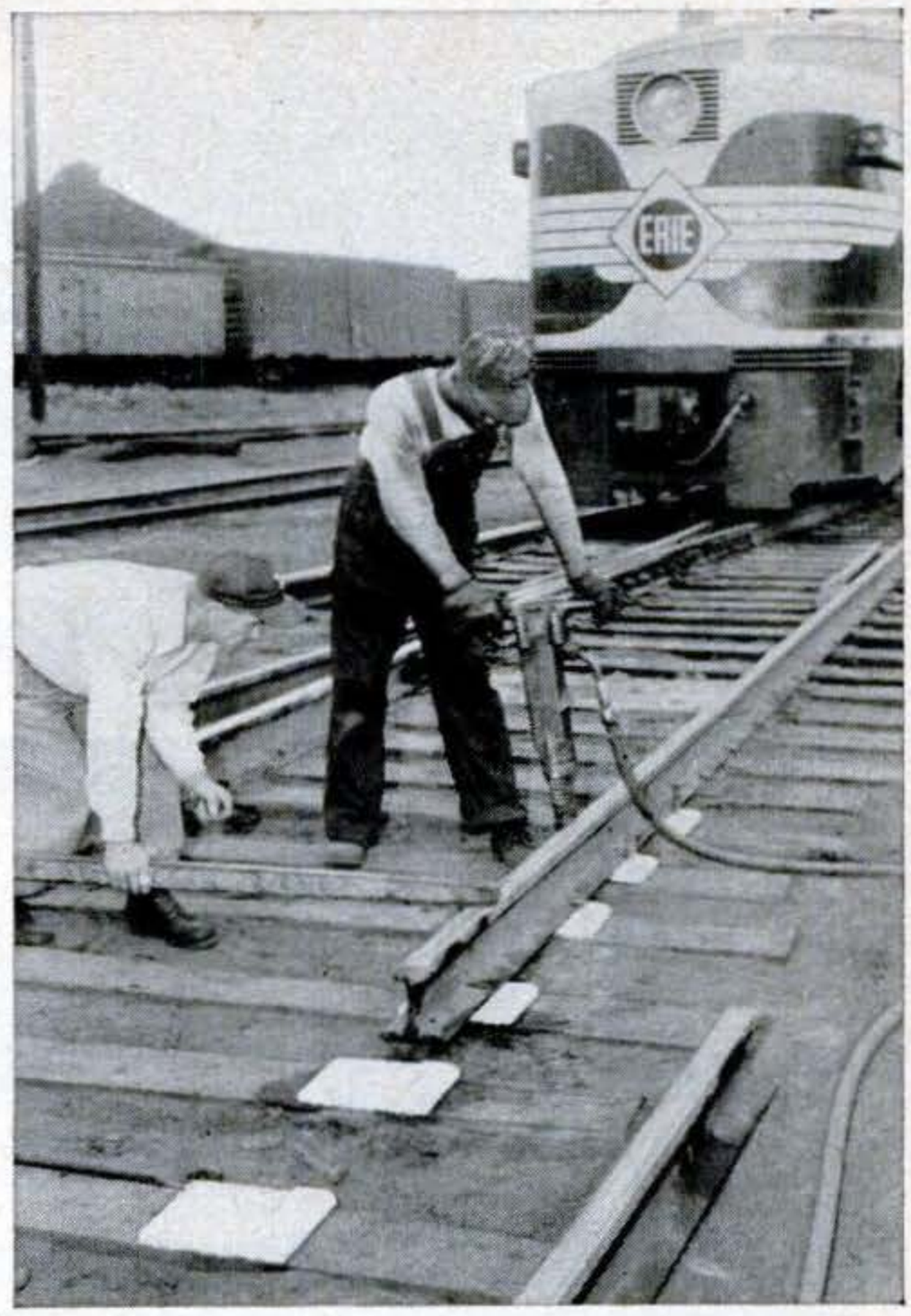
RIG GAUGES SPEED OF DRIVER'S REFLEXES. When instructor gives "stop" signal, he sets off electromagnet and plunger fires chalk at road. Driver hits brake, also firing chalk. Marks indicate reaction time. T/Sgt. E. Platt (left), first to take test, did okay.

FINGERTIP CONTROL IS DEMONSTRATED by T/Sgt. Hugh D. Seagraves as he wheels a big 12-volt truck battery through the maintenance shop. Carrier was contrived from scrap metal and two salvaged rubber-tired wheels, with a little inventive genius mixed in.



Plastic Plates Cushion Rails

NEWLY developed plastic rail plates, being installed here on an experimental stretch of Erie Railroad track, are lighter than steel, more resilient, and resist corrosion. The maker, Dynakon Corp. of Cleveland, predicts a saving for the railroad in handling and maintenance—and passengers are promised a smoother ride.

Telephone Is Valet

HERE'S the "Valeteria," designed for bus and rail terminals, supermarkets and apartment houses. It takes your order for cleaning or pressing, accepts coins, makes change and opens its locker doors to receive or deliver garments—all by telephone. A truck picks up and returns the work.

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My First Ride on the

IGNITION AND LIGHT SWITCH

CLUTCH LEVER

THROTTLE

GEAR-SHIFT CONTROL

FRONT-WHEEL-BRAKE LEVER

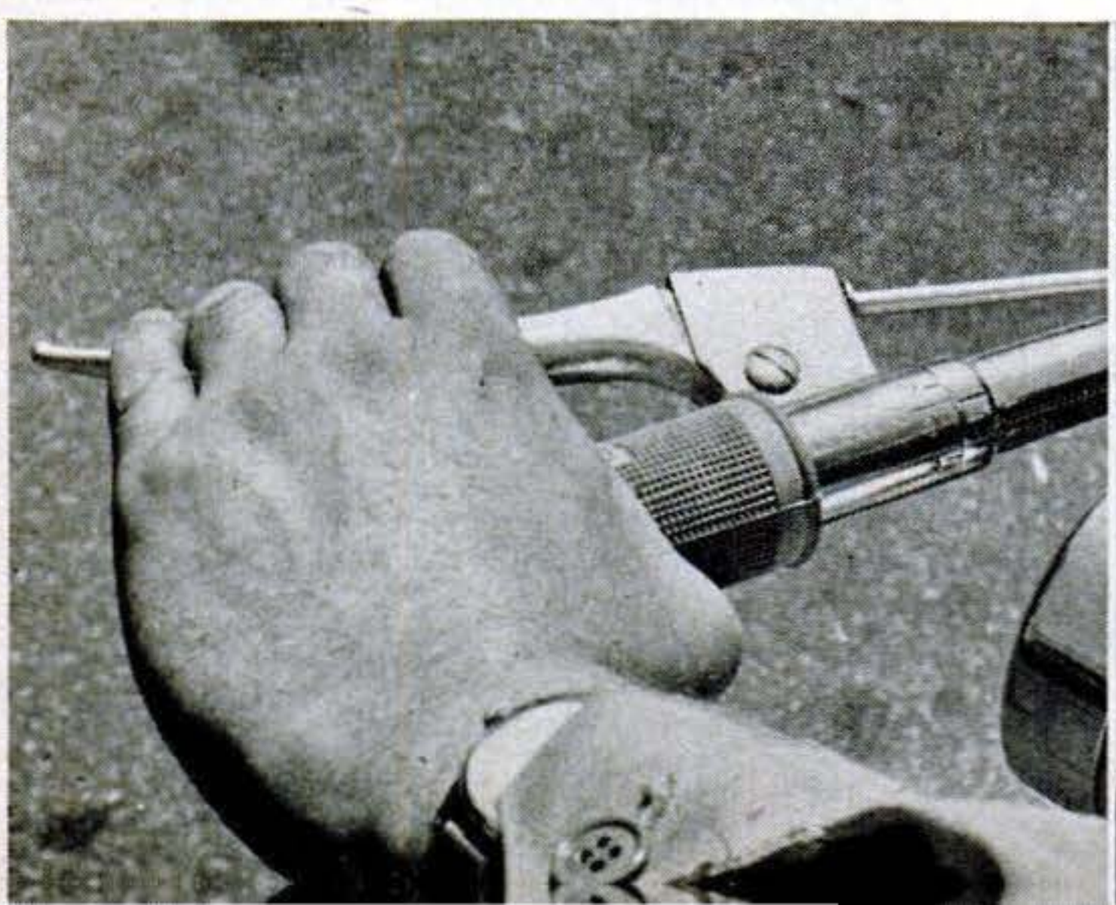
REAR-WHEEL-BRAKE PEDAL

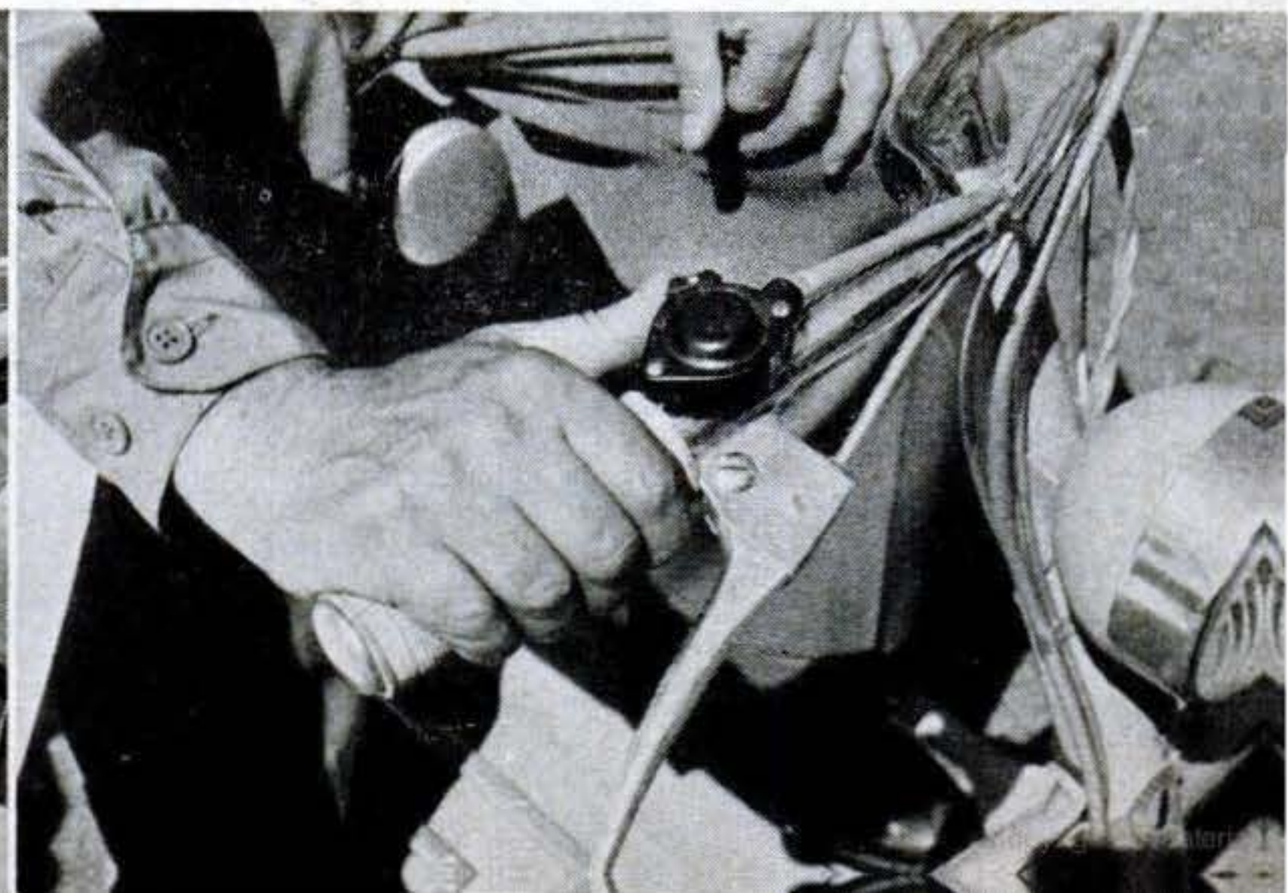
KICK-STARTER PEDAL

Here are controls you use when you go for a spin on three-speed, 4.3-hp. Lambretta scooter.

TURNING LEFT-HAND GRIP shifts gears from neutral to first, second or third. Numbered marks at right of grip show positions. Rider's fingers are on control lever of clutch.

RIGHT-HAND GRIP twists to open or close throttle. Thumb rests on ignition and light switch. Lever within fingers' reach applies one of two brakes, the one on the front wheel.

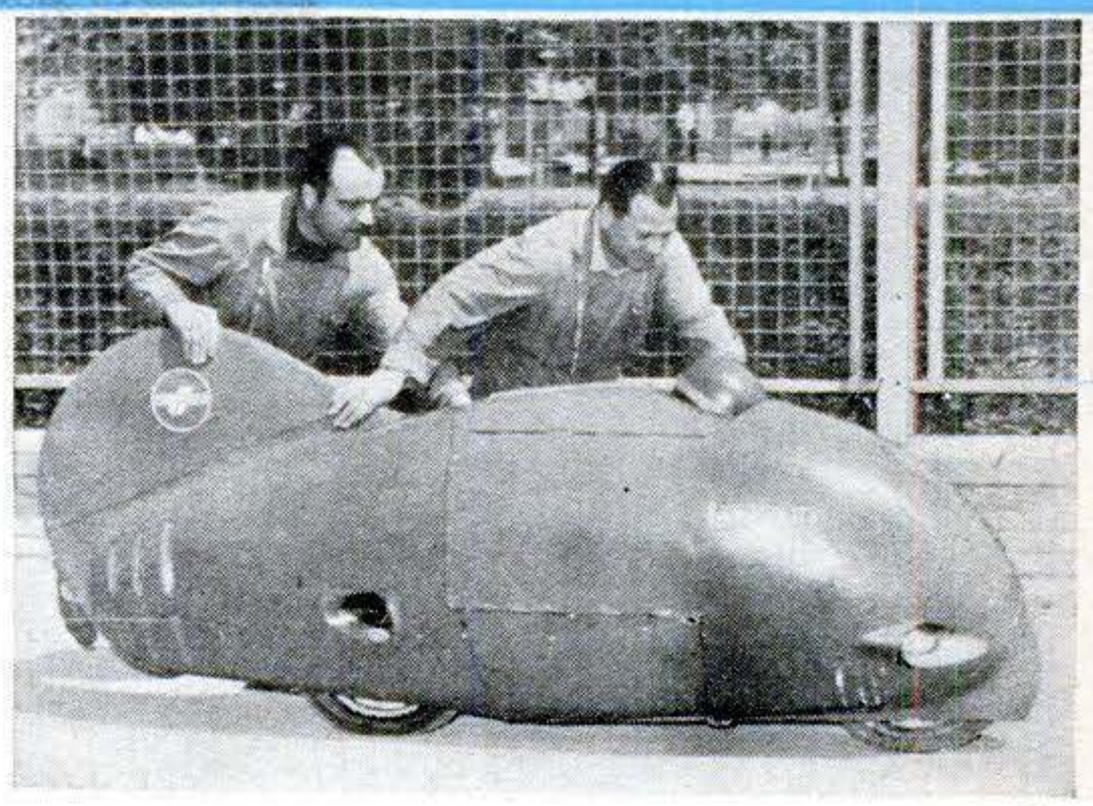




World's Fastest Scooter

Souped-up, a Lambretta will do 125, but even a greenhorn can quickly learn to handle this stock model.

By Tom Compere



WORLD RECORD OF 125.5 M.P.H. was recently set by this streamlined Lambretta in Germany. Driver lies prone, with only helmet showing. He sees through window in nose.

THE traffic light at Main and the Boulevard turned red. I eased my shiny new Italian-made scooter to a stop in a yard-wide space between a station wagon and a truck. The driver of the station wagon looked down at my 175 pounds astride the diminutive 145-pound vehicle. He grinned.

"Give her the gun!" he called out as the light turned green.

I spun both handlebar grips, the one-cylinder engine responded, and gears meshed. The scooter shot past the station wagon. Twisting the left hand grip again, I shifted into second and picked up momentum. I went into third with another turn of the grip.

Scooter Can Scamper

I had never driven a scooter before. After less than 30 minutes' instruction, I was trying my hand in downtown traffic of Port Washington, N. Y. Hearing the muffled put-put of the 4.3-hp. engine, people turned and stared at the midget cycle.

In front of the bank, a traffic cop held up his hand. My left-hand fingers pressed a lever releasing the clutch. By twisting the left-hand grip, I shifted into neutral. My right hand turned that grip to close the throttle. My right foot pressed a brake pedal lightly. All this took but an instant. I stopped smoothly "on a dime."

My friend in the station wagon pulled alongside. His patronizing air was gone.

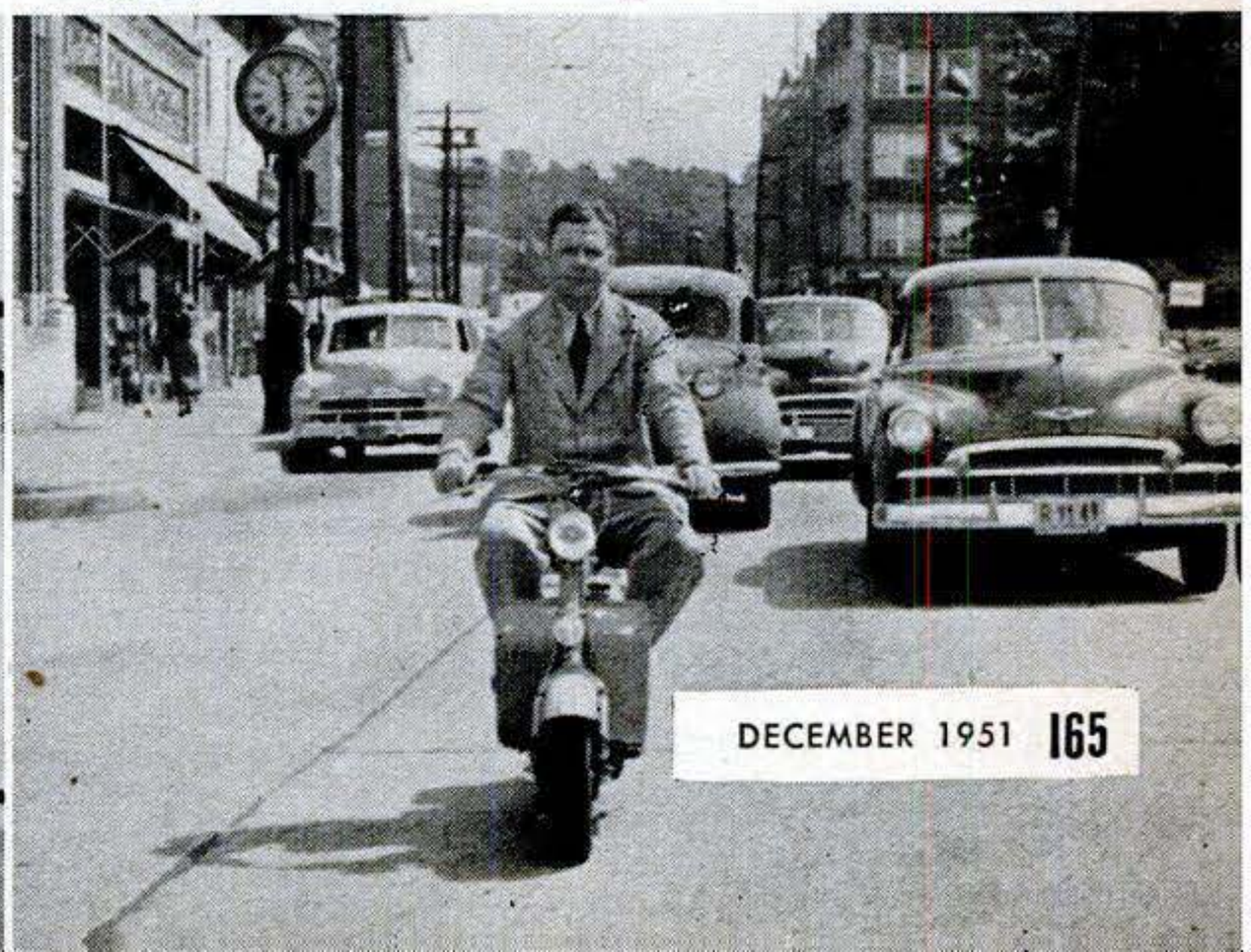
"That's got scat," he said. "What is it?"

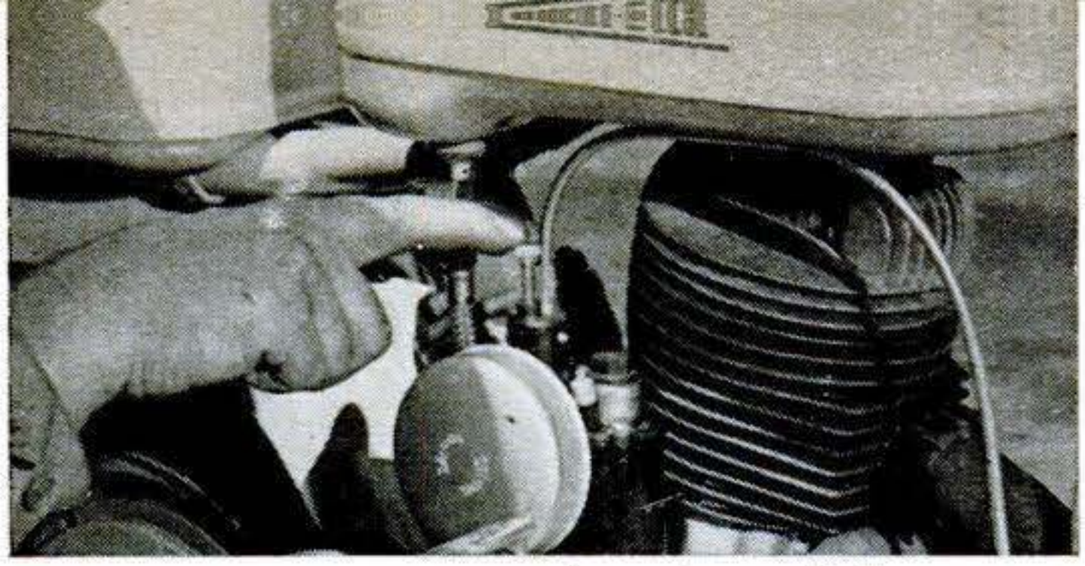
I was riding a little green Lambretta two-wheeler like tens of thousands on the road in Italy, where the Innocenti works is producing 300 a day—a stock model of "the fastest scooter in the world."

A souped-up Lambretta with a streamlined shell was officially clocked at a record speed of 125.5 m.p.h. last summer in a fly-

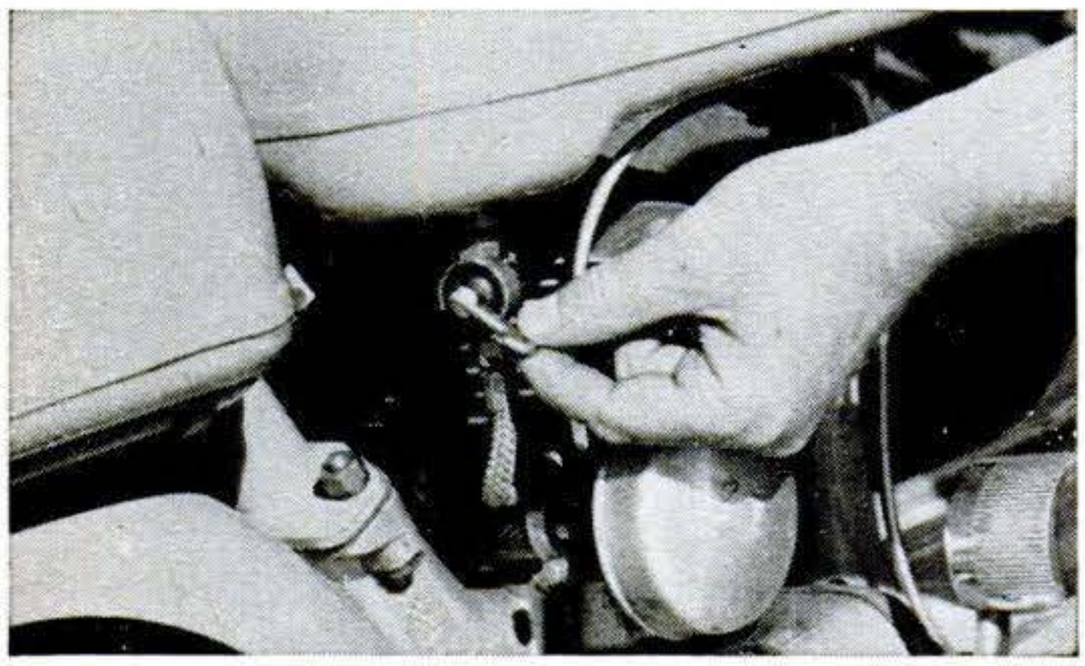
LESS THAN 30 MINUTES' COACHING from instructor (riding as passenger below) enabled author to get the hang of controls and pilot scooter confidently through traffic.

TRYING OUT SCOOTER in city streets, author finds it has fast getaway as lights turn green. It threads its way easily through tight places to get past slower-moving vehicles.

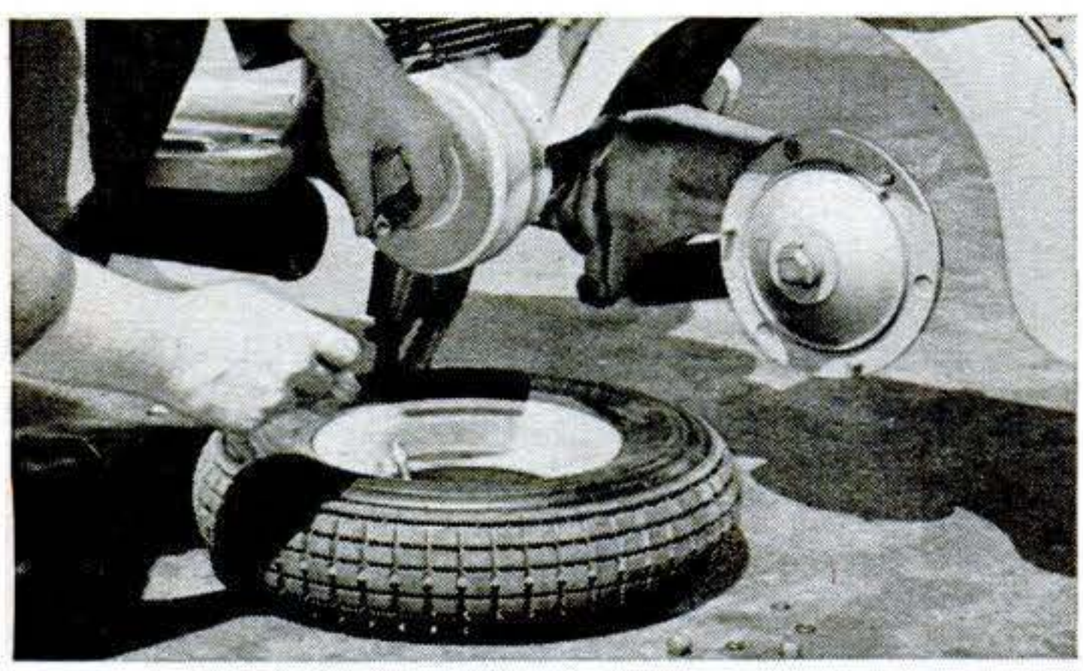




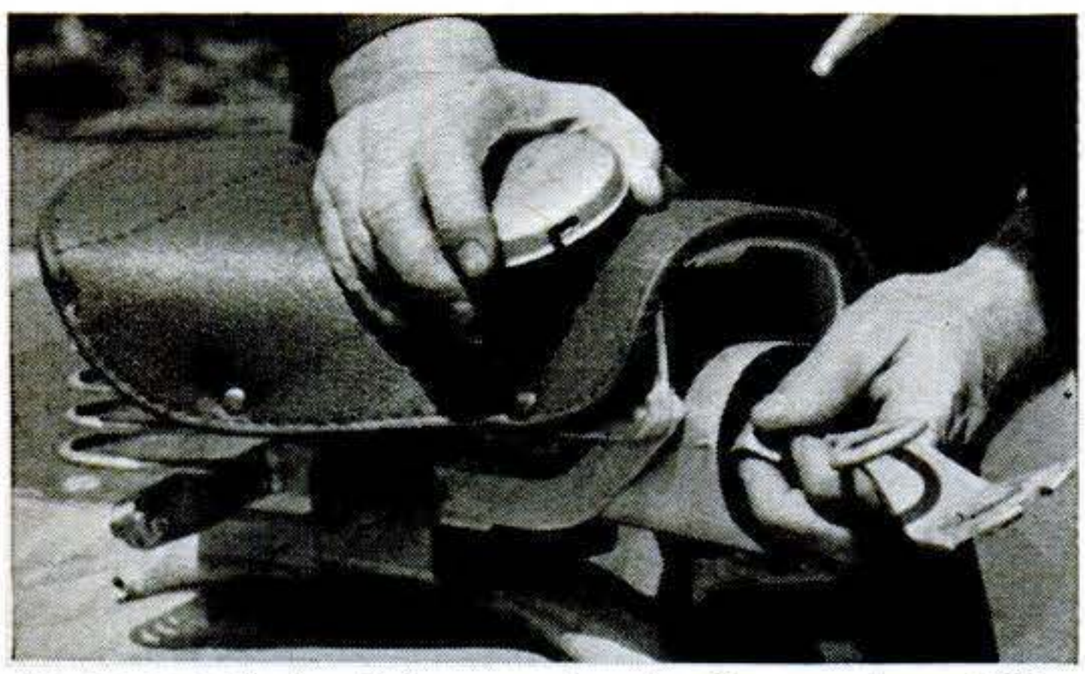
ONE-CYLINDER, two-cycle air-cooled engine develops 4.3 hp. at 4,000 r.p.m. It propels stock-model scooter at top speed of 50 m.p.h. and economical cruising speed of 35 m.p.h.



PETCOCK CONTROLS FLOW OF FUEL, 95 percent gasoline and 5 percent No. 30 oil, to engine. Tank just below saddle holds 1.3 gallons plus another half-pint in reserve compartment.



REMOVING REAR WHEEL took the author only 70 seconds on his first try. You simply loosen three lugs, and wheel and tire slip off hub on left side, as illustrated in photo above.



TOOL KIT is in this metal tube beneath saddle. Rear fender may carry spare tire and steel box serving as luggage holder. An extra saddle may be fitted above luggage container.

ing mile on the Munich-Ingolstadt Autobahn in Germany. A steel shell fitted over the scooter made it look like a bullet on wheels, with a small tail fin.

The driver, Romulo Ferri, lay prone within the shell during this and other record-shattering runs. He saw where he was going through a transparent panel in the nose. Driver, scooter and shell totaled about 330 pounds. A supercharger was added to the 125-c.c. engine. The fuel was a mixture of gasoline, benzol, methanol and oil.

Engine Is Underneath Seat

Mine had exactly the same engine displacement, gears, shaft, wheelbase, suspension and many other features; but it was not in the 100-mile-an-hour class. The stock-model Lambretta will go from three to 50 miles per hour—which was fast enough for me. At cruising speed of 35 m.p.h., it makes 100 miles to the gallon.

The scooter has an over-all length of 68¾ inches. Handlebar width is 30 inches. The frame is of tubular steel. The saddle is just below waist level, beside a man of average height, with ample leg room between it and a metal leg shield extending partway up the handlebar post. The rider rests his feet on a footboard 15 inches wide that runs along the lower steel frame.

The single-cylinder, two-cycle engine is mounted directly beneath the fuel tank and saddle. Displacement is 125 cubic centimeters, or 7½ cubic inches. A small gearbox at the lower right side of the engine holds the bevel gears for first, second and third speeds. A steel drive shaft 4⅛ inches long, weighing 1½ ounces, connects the gears with cogs on the rear wheel. A flexible-steel cable connects the gearshift control to the gearbox. The clutch is of multiple-disk type.

Both Wheels Have Brakes

Its gearshift drive, and elements of the clutch system, are major differences between the Lambretta and U.S.-made scooters. Most American scooters have automatic clutches, with no gearshifts. (However, one model has a shift, with two speeds.) The drive of most American scooters is by V-belt or chain or a combination of them.

The throttle control of the Lambretta is the right handlebar grip. A twist, and it begins to open. A lever beside it applies a front-wheel brake. A pedal on the right side of the floorboard operates a rear-wheel brake. A combination switch, on the right

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handlebar, controls the high-and-low-beam headlamp, the tail lamp, the horn and the ignition.

Rear-wheel suspension employs a hydraulic shock absorber; that of the front wheel, a double coil spring. Tires are of 4 x 8 size and low-pressure, antiskid type. Accessories furnished as extras include speedometer, spare tire and a saddle for a second rider.

Pick-up Like a Fighter Plane

The tank beneath the saddle holds 1.3 gallons of gas-oil fuel. Mixing the fuel is easy. The underside of the tank cap forms a small cup to measure the oil. First you put a gallon of gas in the tank, and then pour in two of these cupfuls of No. 30 oil. Shake the scooter, and the mixture is made.

In New York, the 145-pound model of the Lambretta sells for $315 through Consolidated Distributors, Inc. A heavier, de luxe model costs $375.

On the highway, the scooter responded to the throttle like a fighter plane on a take-off run, zipping past autos and trucks. The wind flattened my hair, pleasantly stung my face and whipped my jacket up in back. With the throttle about three-fourths open, and no speedometer to tell my speed, it seemed to me that I must be going 80 m.p.h. As I later learned from the driver of a car following me, I was actually making 41 m.p.h.

The Lambretta took a rough and hilly trail in its stride. The metal footboard's 10-inch clearance proved ample. The going was slow but sure in first and second speeds.

The Lambretta's weight distribution and broad tires give it almost perfect balance, making it easy for a novice to ride it with a feeling of safety. Its precision gearshift works smoothly. A snap to park, the scooter is easy to handle in traffic.

Long-distance jaunts by scooter are practical, too. One owner of a stock-model Lambretta made a round trip of nearly 6,000 miles between Milan, Italy, and Port Said in Egypt. An even more ambitious one rode his scooter from Milan to Skibotin, at the extreme northern tip of Norway, and back, totaling more than 7,300 miles.

But whatever you use it for, riding this scooter is fun. END

DRIVING THE LAMBRETTA on a rough trail in a wooded section lent variety to author's first morning of scootering. Even up sharp grades the little scooter made it—slow but sure.

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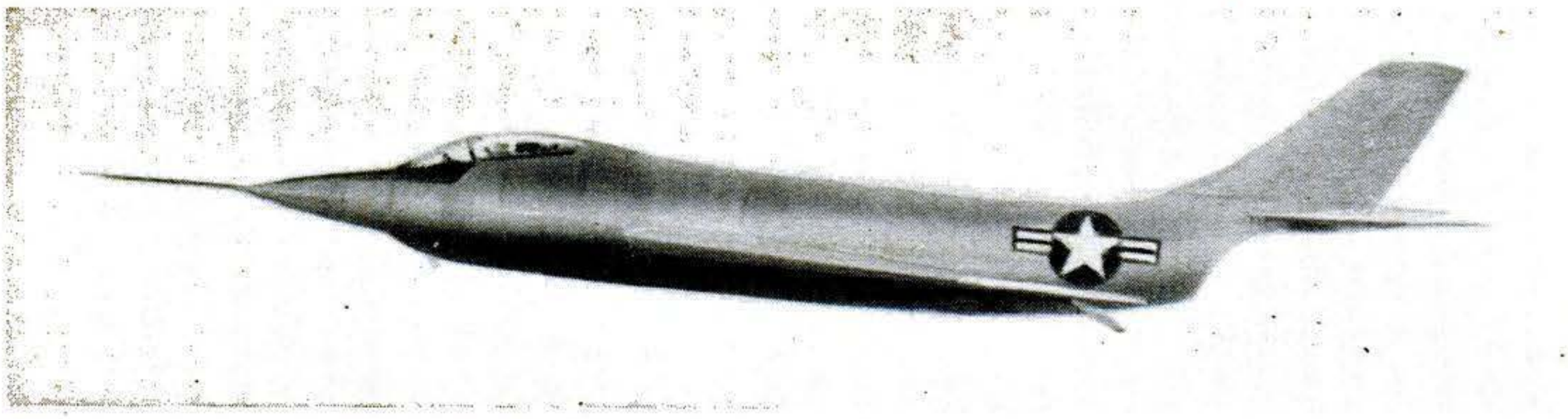
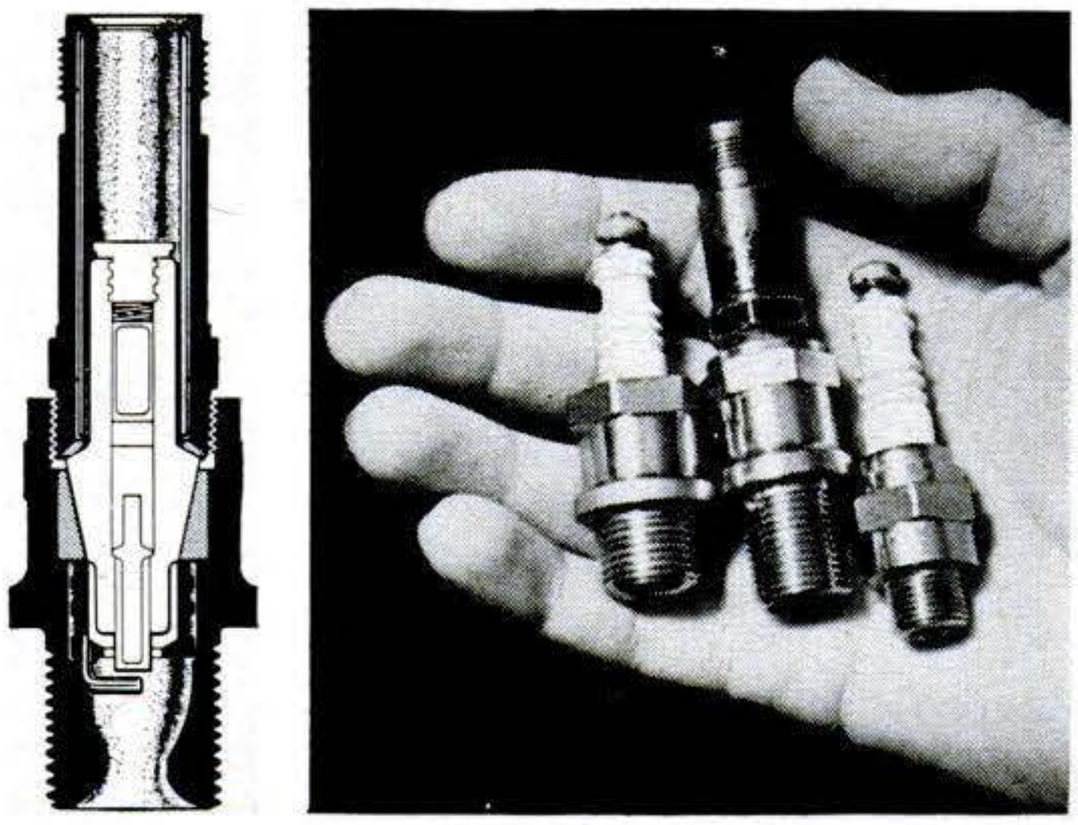


New Navy Jet Tops 700 M.P.H.

THE Navy's latest carrier-based jet fighter, the F3H-1 Demon, shown above on its first test flight, is believed to be capable of speeds in excess of 700 miles an hour. Resembling a giant swordfish, the McDonnell plane is powered by a J-40 Westinghouse jet engine. Outstanding feature is unusual tail configuration. Air intakes can be seen under the cockpit.

House Makes Sea Voyage

THIS two-story house, mounted on pontoons, was photographed before starting on a nine-mile ocean trip. When the tide rose, two tugs towed the house from Kennebunk to Goose Rocks Beach, Me., to replace a community house destroyed by forest fire. The moving job cost $4,000—four times the purchase price of the house.



Spark Plugs Are Non-Fouling

LONGER life is claimed for a new spark plug whose points are shielded within a pre-combustion chamber instead of projecting into the cylinder. Because it is protected from fouling, one model plug works in all car engines. The three above are for (left to right) outboard engines, airplanes and cars. The plug was developed by Boeing.

Mobile TV Station to Show Army Maneuvers

THE Army can now televise field exercises to distant classrooms with this mobile unit developed by the Signal Corps and RCA. At right are two 10-ton coaches comprising power supply, cameras and transmitters. At the receiving end are two similar vehicles equipped with 10 receivers and a large-screen TV projector.

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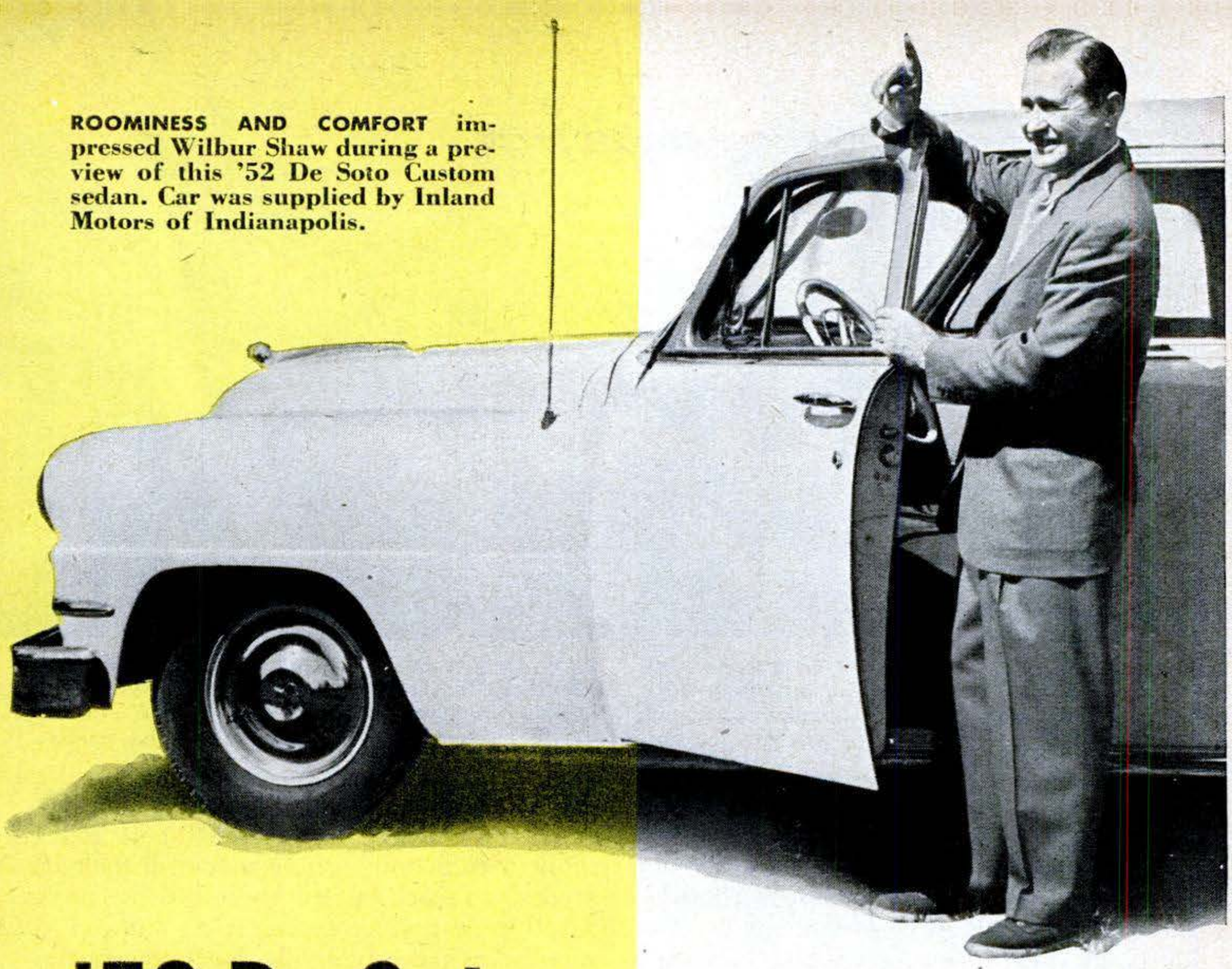

ROOMINESS AND COMFORT impressed Wilbur Shaw during a preview of this '52 De Soto Custom sedan. Car was supplied by Inland Motors of Indianapolis.

'52 De Soto Is Built for Keeps

Big, solid and fast, it combines limousine lushness with snap that will take you past 94 m.p.h.

By Wilbur Shaw and Devon Francis

THE windshield was blotchy from rain and dust, and we turned to the De Soto representative beside us in the front seat to ask whether the car had one of those squirter gimmicks.

"The button's right down there." He pointed between the pedals of the '52-model Custom four-door sedan announced last month.

Characteristically, the button was king-size, fully an inch in diameter. Whatever the Chrysler Corp. puts on any of its four lines of cars—Chryslers, De Sotos, Dodges and Plymouths—is put there for keeps. A tromp on the button brought water gushing.

We were driving along Detroit's wide-laned Expressway to the Willow Run airport. But there was little danger of detection of our '52 model by passing motorists. The changes in the car from the '51 were subtle. In common with most of the other automobile manufacturers, De Soto has stopped short of even a face-lift in its turn-of-the-year models. Production cutbacks and material shortages are the reason.

The car's acceleration was the first order

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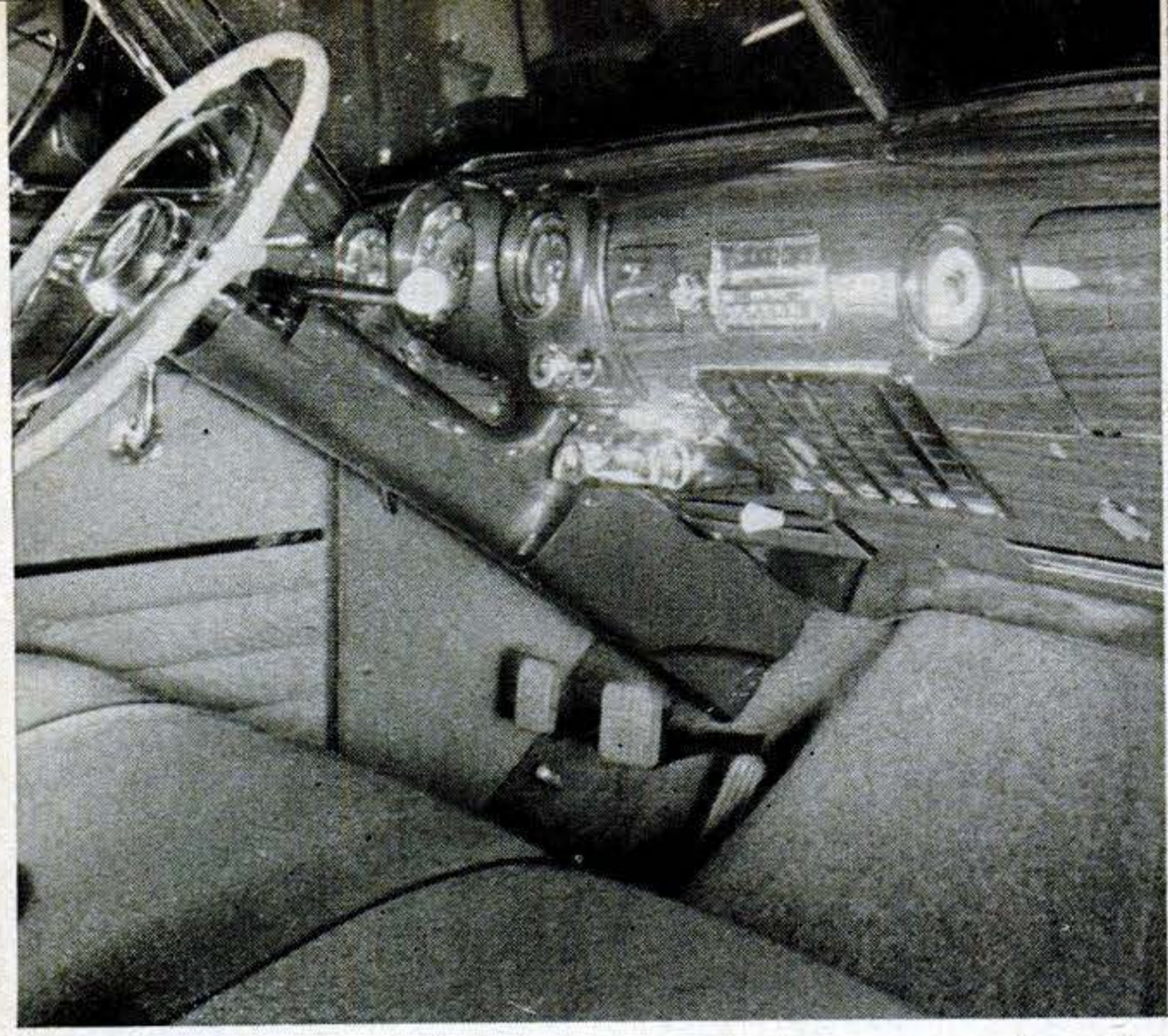

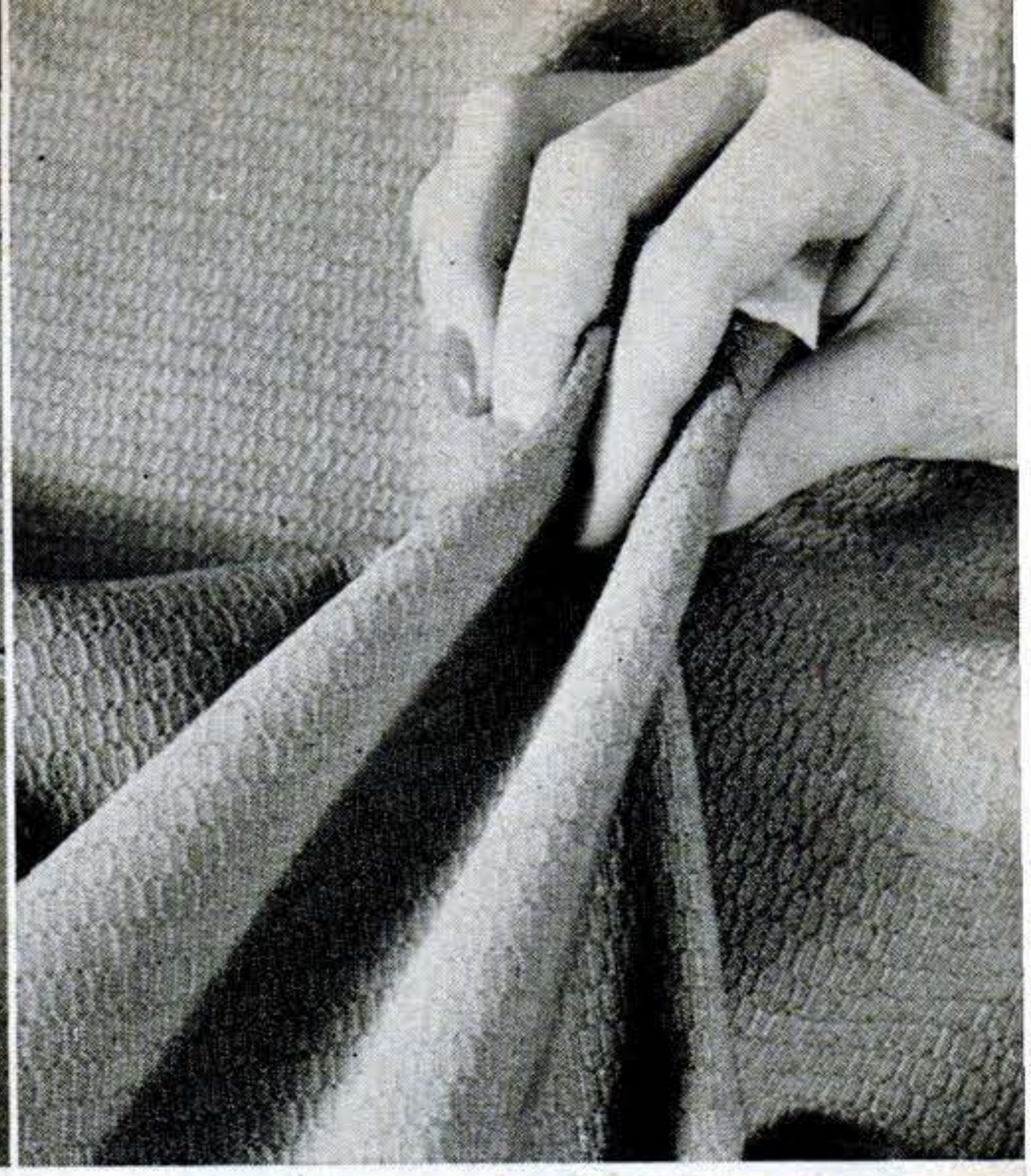

INSTRUMENT PANEL simulates wood. An outstanding feature is automatic entrance light on apron under panel. Driver's entrance room measures 45 by 28½ inches. Upholstery fabrics are being accommodated to material shortages. De Soto tried many wool substitutes before settling on cellulose acetate (right above). It wears well, cleans easily.

of business on our drive. The De Soto does not have an "automatic" transmission as the public has come to accept the term. It has a fluid flywheel—the well-known Chrysler Fluid Drive—and gears sorted out for low and high ranges set manually. The shift from low to high gear within either of the ranges is hydraulic and automatic (PS, April '50, p. 101).

From a dead stop, with the shift lever in high range, the car reached an indicated 60 miles an hour in 18 seconds under hard accelerator pressure. For fast acceleration, the shift from low to high gear can be delayed, by keeping the treadle on the floorboard, until the car hits an indicated 50. The time was good—in anything but hot-rod circles. By lifting the foot at 40 miles an hour to permit shifting sooner, it took 26 seconds to reach 60. But those extra seconds saved some gas. An engine that's allowed to race burns more fuel. The lag between the release of one gear and the meshing of the second could be improved.

Next, we tried starting in low range. A short run with the accelerator on the floorboard established the fact that the engine "peaked" for maximum power output at 33 m.p.h. By experimenting, we found that the best time we could achieve by starting in low range and shifting to high required a manual shift at 15 m.p.h. Going on up

FACTS ON THE '52 DE SOTO

Make and model: De Soto four-door Custom Sedan.

Engine: 6-cyl. L-head; 116 hp. at 3,600 r.p.m.; car weight per hp., 32.6 lb.; bore and stroke, 3 7/16" by 4½"; compression ratio, 7:1; piston displacement, 250.6 cu. in.

Engine piston travel: (in feet per car mile at 20 m.p.h.) 2,120.

Crankshaft bearing surface: 43.8 sq. in.

Torque: 208 lb.-ft. at 1,600 r.p.m.

Transmission: Tip-Toe Shift semi-automatic, 4 speeds forward.

Rear-axle ratio: 3.9:1.

Steering ratio: 18.2:1 (2½ turns lock-to-lock).

Radius of turning circle: 20.2'.

Effective brake-lining area: 201.1 sq. in.

Springs: front, coil; rear, semi-elliptic.

Weight and outside dimensions: 3,785 lb.; height (no load), 64⅞"; over-all length with bumpers and guards, 208⅜"; width, 74⅞"; wheelbase, 125½"; front overhang, 36¾"; rear, 46⅛"; tread, front, 56 5/16"; rear, 59 9/16".

Inside dimensions: seat-cushion width, front, 57"; rear, 58⅞"; leg room, front, 41⅞"; rear, 41½"; headroom, front, 36½"; rear, 36"; seat height, front, 15"; rear, 15½"; vertical distance, steering wheel to seat cushion, with seat in mid-position, 5⅞"; front-seat adjustment, horizontal, 5"; vertical, 1⅛".

Tire size: 7.60 by 15.

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TAIL-LIGHT DESIGN is changed for '52. De Soto is not saying whether it will follow current trend and abandon its 6-cylinder L-head in favor of overhead valves and more horsepower. Among other features of '52 models are: a different medallion on hood, block instead of script indentification letters, and new combination stop-backup lights.

toward the engine's peaking point only cost acceleration time. The best time to 60, using both ranges, was 22 seconds.

By now, the car had demonstrated that the gear ratios in the transmission and rear axle had been engineered for an adequate getaway in high range on level ground. Low range was just what it was intended to be—a brace of emergency gears for hard pulling.

Torque Effort Is Mechanical

De Soto buyers must bear in mind that the car's fluid flywheel does not multiply torque—it doesn't do a thing to increase the push at the rear wheels in accelerating at low speed, as does a torque converter. The torque effort all comes from mechanical gearing. But the semi-automatic Tip-Toe Shift costs a lot less than a fully automatic transmission.

As we breezed along the Expressway in a smart quartering wind, there was a slight tendency toward wind-wander, undoubtedly due to the height and shape of the body. Chrysler Corp. cars are high. That's because the makers believe that a car must provide, above all things, comfortable transportation.

To determine the stopping distance, the brakes were jammed on at 60 m.p.h. One and three-quarter tons of car jolted to a full stop in 146½ feet, not counting reaction-time distance. It was a hard stop. The tires squealed. And the performance was excellent, a tribute to the corporation's "Cyclebond" brake linings. Moreover, the pitch and rebound as the car stopped and the springs seized the body were less pronounced than we ever had experienced. An exceptionally long wheelbase with relation to total car length undoubtedly had a lot to do with it.

We rolled again, this time to determine the car's top speed. Lifting the foot from the treadle once or twice showed the compression braking was good—considerably better than that of cars with torque-converter transmissions not modified by a lockup feature.

Runs with and against the wind clocked the De Soto's average top speed at a shade more than an indicated 94 m.p.h.—plenty good.

Springs Have No Jounce

The car cornered well, despite its height. It was roomy. The leg room afforded both driver and passengers was nothing short of wonderful, and the chair-height seats gave one the feeling that here was a car that could be driven all day without fatigue.

The shock absorbers—the Oriflows introduced in the '51 models—took practically all the jounce out of the springs, though some tendency toward front-wheel hop on rough pavement was noticeable. That probably was a matter of adjustment.

The '52 De Soto can't disclaim its parentage. It's strictly from a corporation that prides itself on its engineering. END

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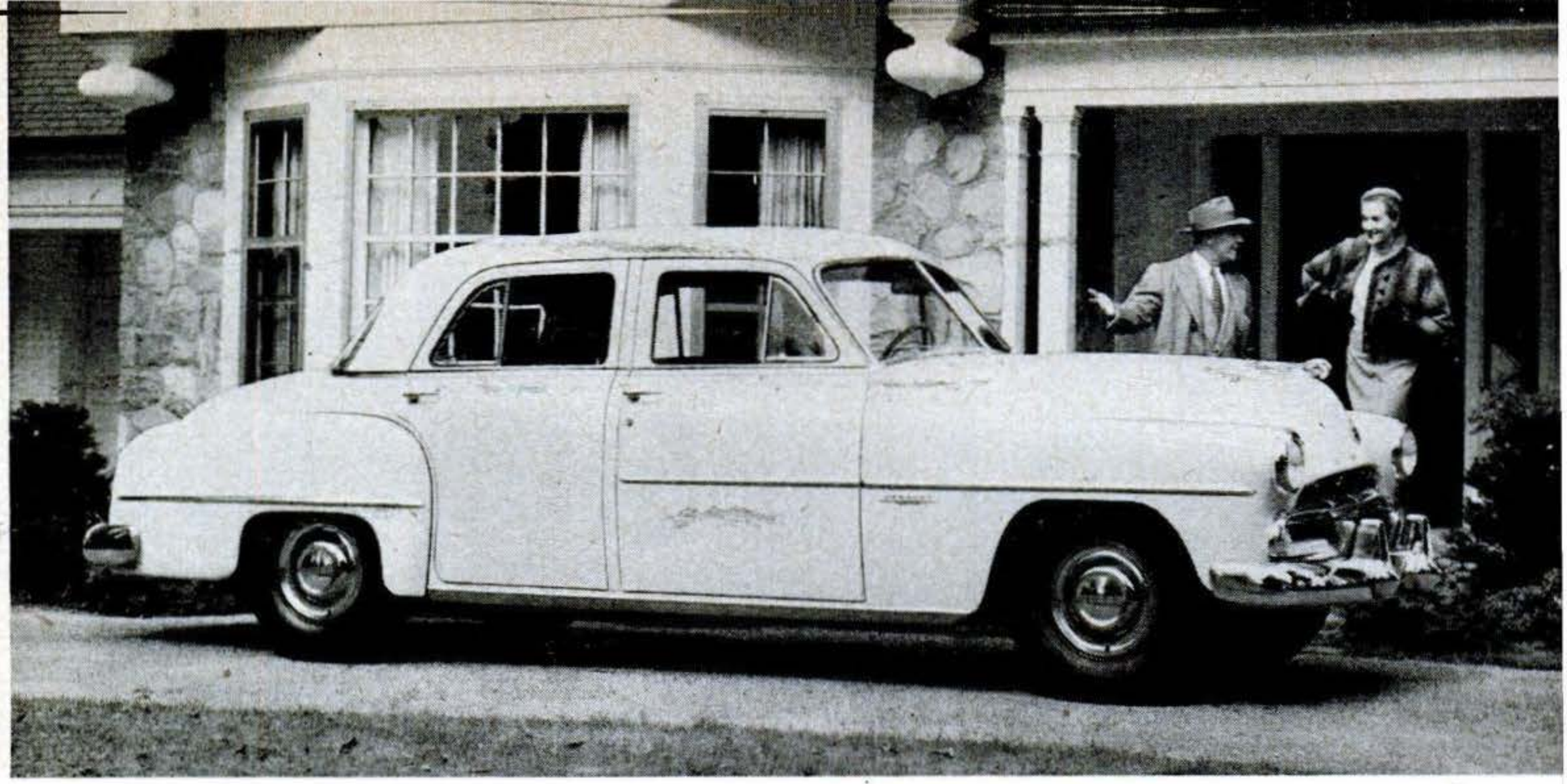

Available steel will be used to build models in top demand, like this Coronet four-door sedan.

1952 Dodge Offers Green-Tinted Windows

A SEMI-AUTOMATIC transmission can now be had on all 1952 Dodges. Gyro-Matic drive, first introduced in 1949 and until now available only on a few models, is offered in combination with Dodge's standard Fluid Drive, in which power is transmitted to the rear wheels through a fluid coupling. Another optional feature is tinted safety glass all around to reduce heat and glare from the sun. Waterproofed ignition, electric windshield wipers and Oriflow shock absorbers are standard equipment. The design of the front grille and rear-fender trim has been modified. Wheel covers, hub caps and tail-light assembly are new. Cotton and rayon combination upholstery fabrics, which are being used in the Coronet models, are said to be more durable and easier to clean.

TINTED SAFETY-GLASS WINDOWS and windshield are designed to cut down glare and reduce the heat that pours into car on hot day. Glass has slightly greenish color.

Still Uses Sun's Rays to Make Sea Water Drinkable

THIS downed airman, who appears to be leisurely sipping a soda, is drinking purified sea water from an inflatable Navy still that produces up to 2½ quarts a day. Suspended inside the pliable plastic sphere is a black cloth bag. Sea water poured into the bag evaporates from the sun's heat, condenses against the cooler plastic and runs down into a reservoir.

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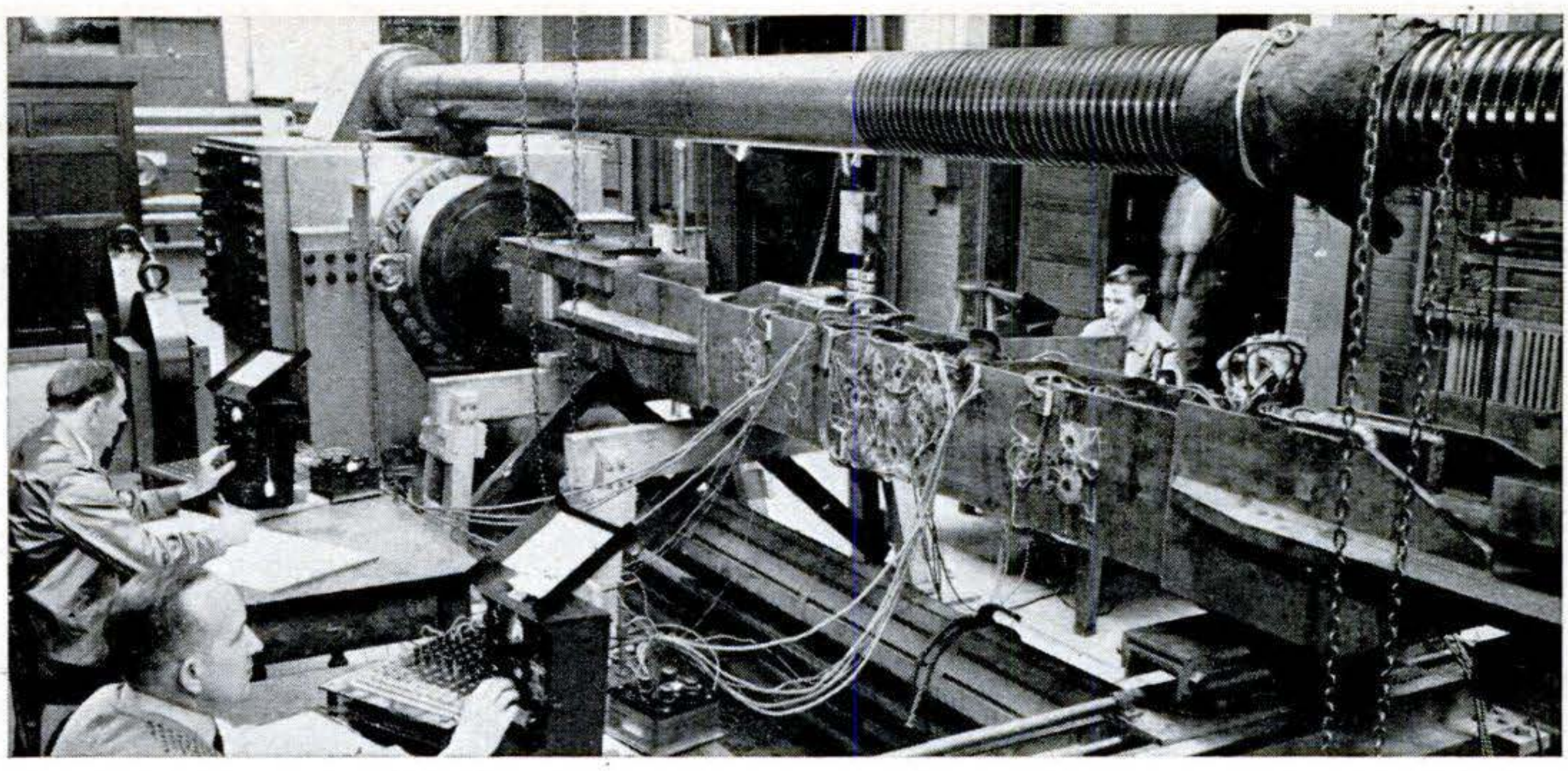
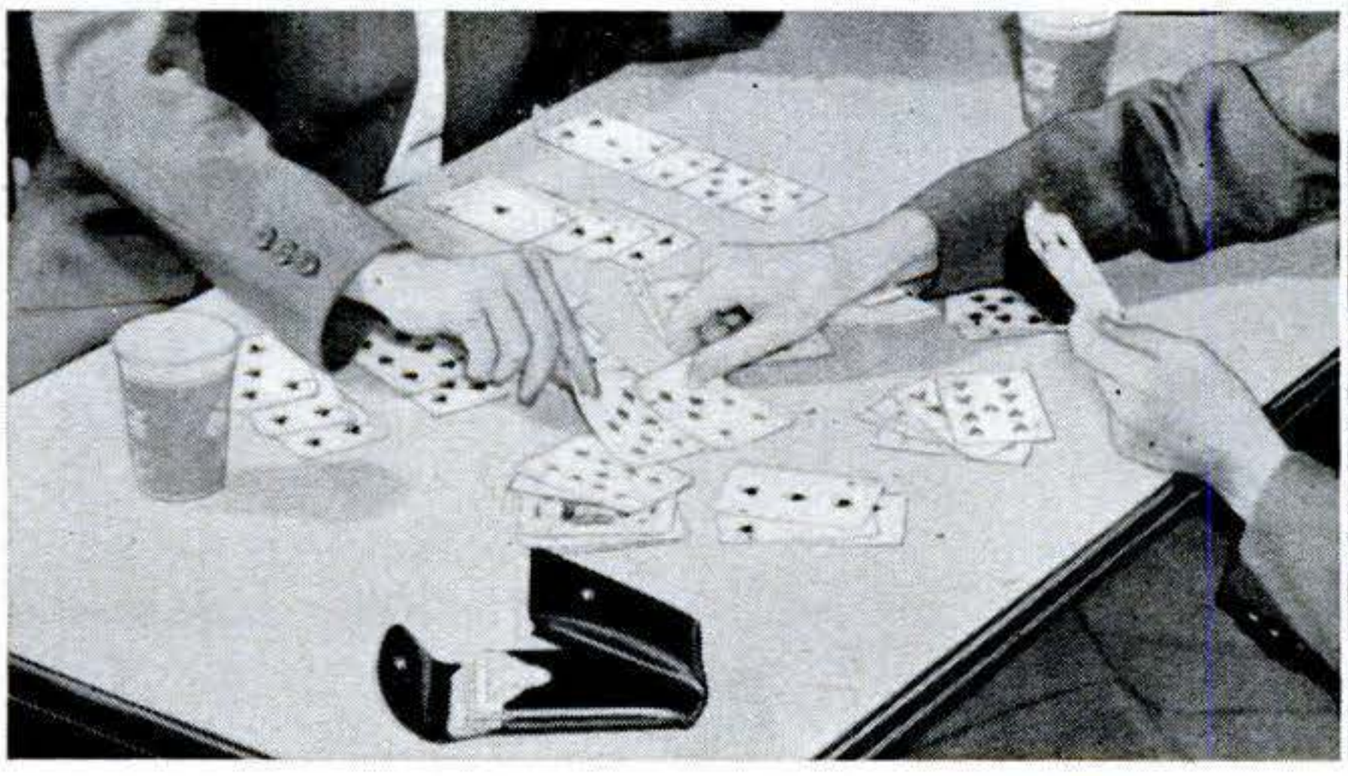


Strain Put on a Giant Girder

THE horizontal testing machine above enables observers at the National Bureau of Standards, Washington, to study metal structures under tension. Strain gauges placed strategically along the welded ship girder indicate any deformations as tension is increased. This huge steel girder withstood the equivalent of an 843,000-pound load before failing.

Truck Plugs In

THIS electric mine car just plugs into any convenient power outlet and rambles off trailing a 600-foot "extension cord" behind it. Designed to haul coal through narrow mine pits, the GE car has tank-like tracks and a movable conveyor-belt loader. The cord automatically reels in or out as the truck moves.



Playing Cards Can Take It

NO GAME is too rough for these cards made from sheet plastic. They wipe clean and are said not to chip, warp or fray. Two decks are packed in a pocket-size wallet designed for servicemen, travelers and sportsmen. And if a card is lost, it can be replaced from a library (right, above) maintained by the maker, Northbrook Plastic Card Co., Northbrook, Ill.

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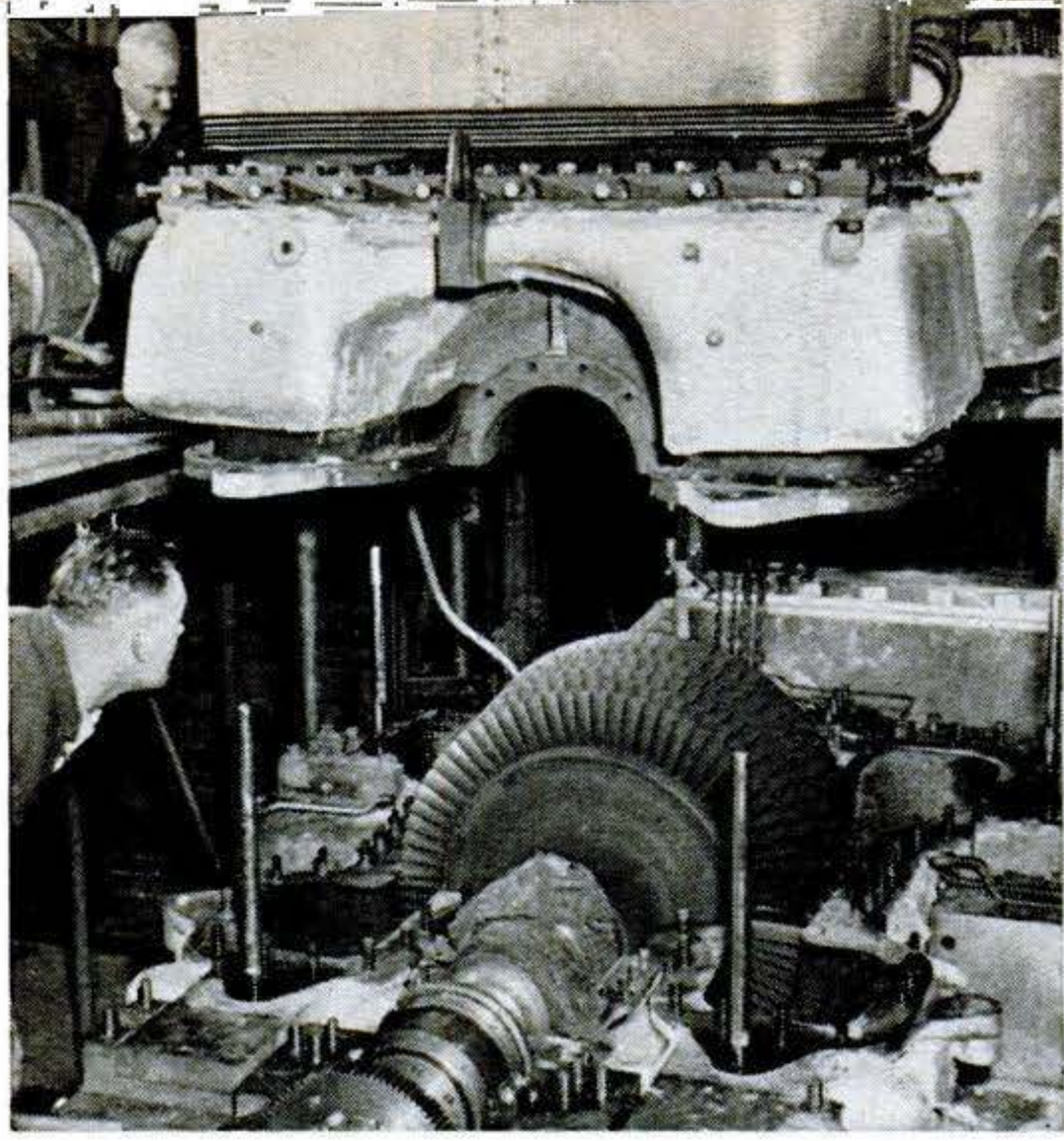
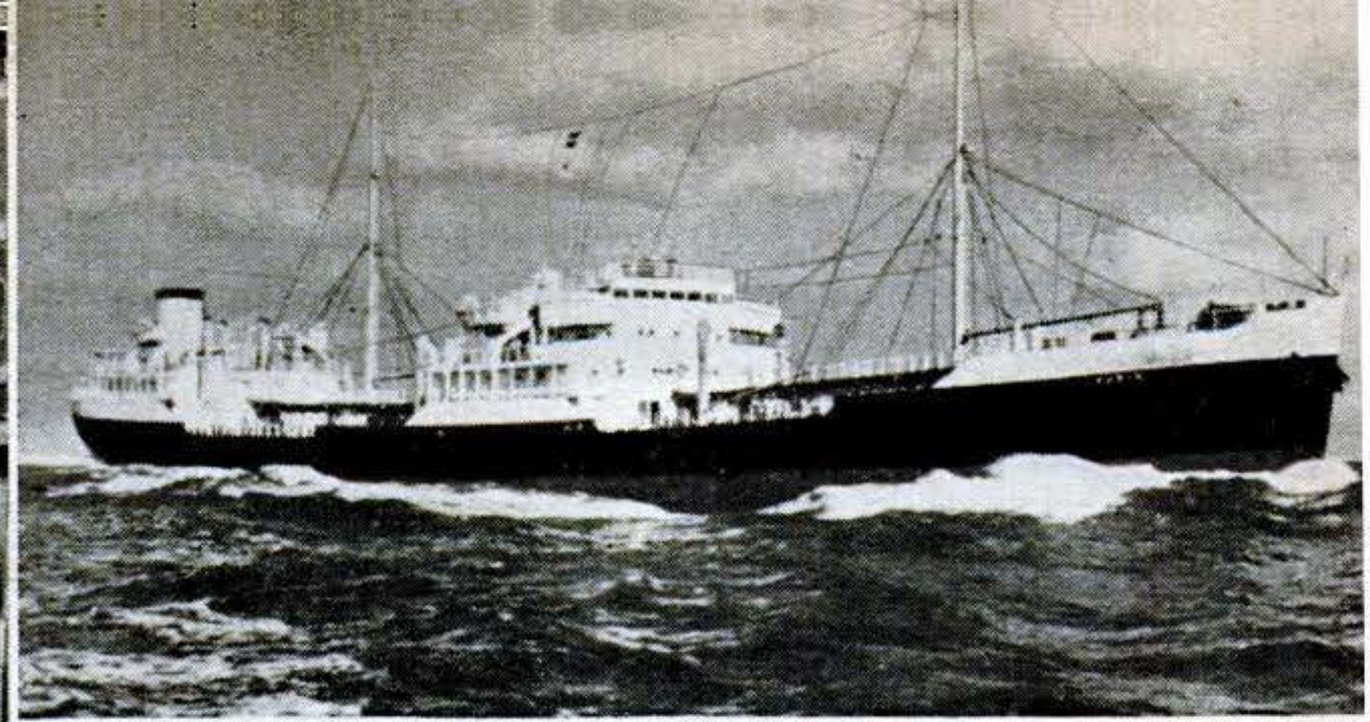


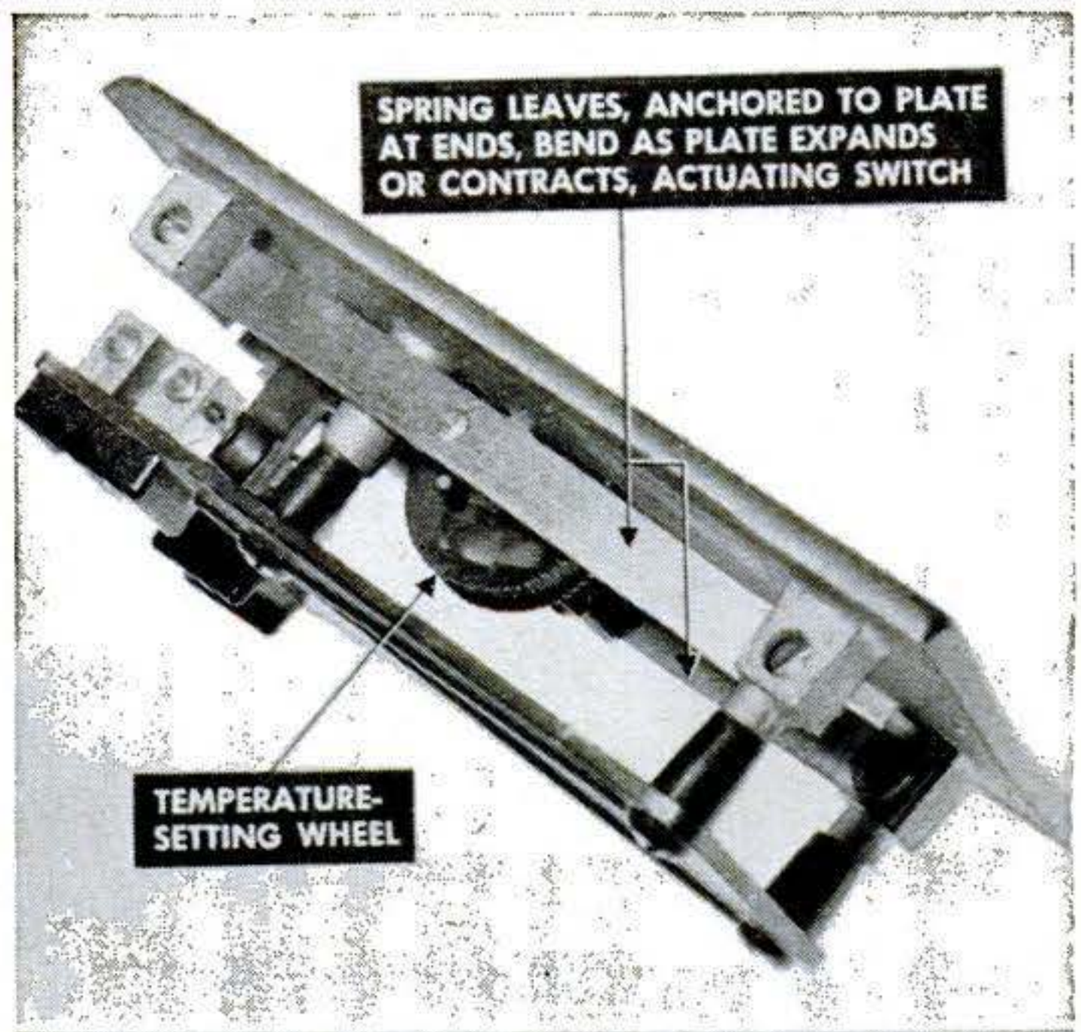


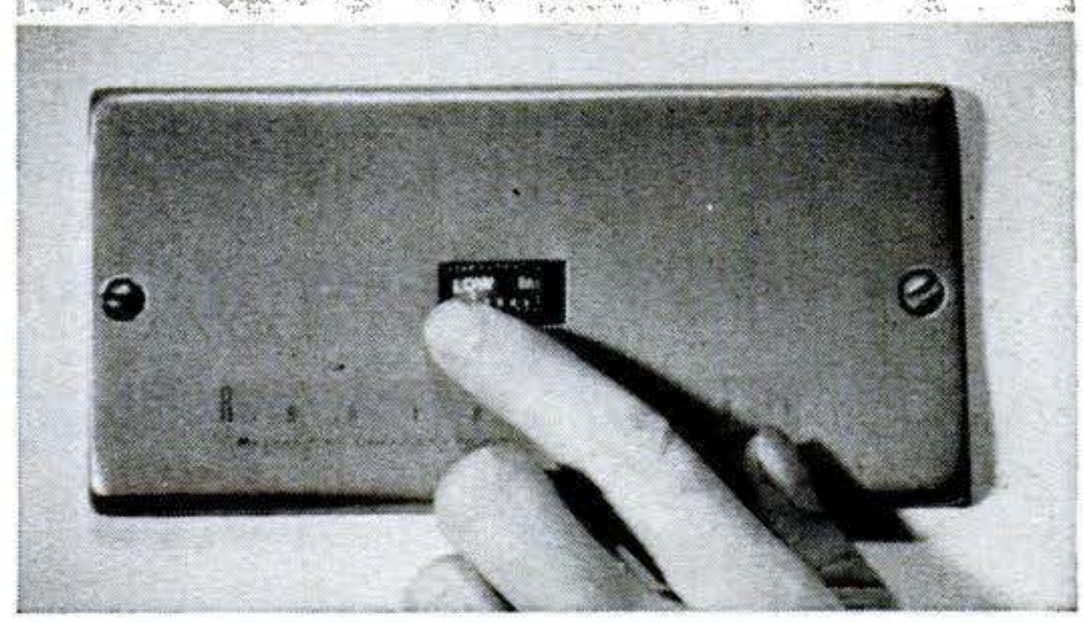
Gas Turbine Drives Tanker

THE first gas turbine in a merchant ship (left) now helps propel the 10,000-ton British tanker *Auris*, replacing one of four Diesel engines. If trials go well, the Diesel-electric vessel will be completely converted to gas-turbine power.

Hot Atoms Treat Cancer

IT WOULD take all the radium in the world, estimated at three or four pounds, to rival the power of the new cancer-fighting "gun" below. First of its kind, the General Electric apparatus applies gamma rays from four wafers of cobalt an inch square and ⅜-inch thick, made powerfully radioactive in an atomic pile. The photo shows how the cobalt gun will be used to treat patients in a Houston hospital.





New Thermostat Sunk in Wall

THIS new room thermostat for electric-panel heating can be set flush in the wall. The temperature-sensitive element is the metal wall plate itself. Actuated by its expansion or contraction, an electric switch controls current flow directly, dispensing with a conventional relay. A finger wheel (lower view) adjusts temperature setting. The Radiantrol is made by Harry Alfred Mulvaney Laboratory, Berkeley, Calif.

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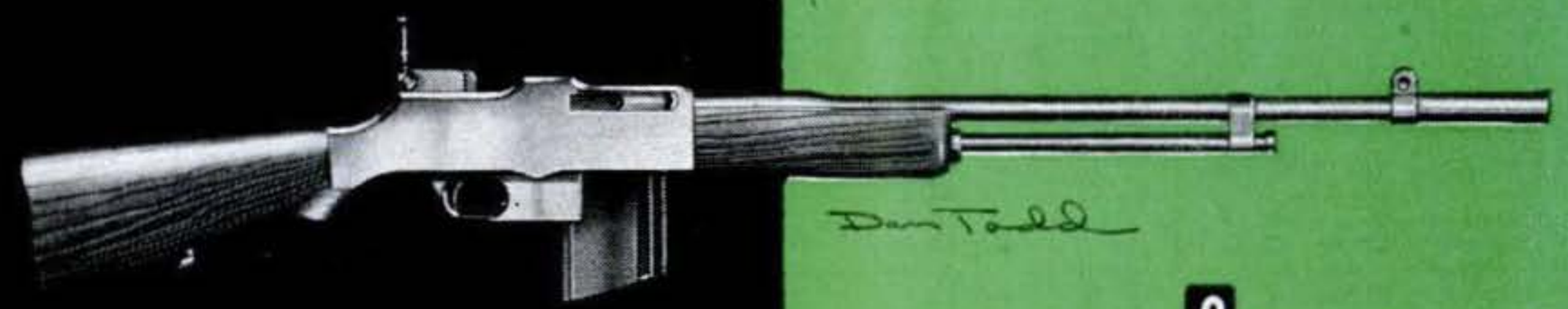
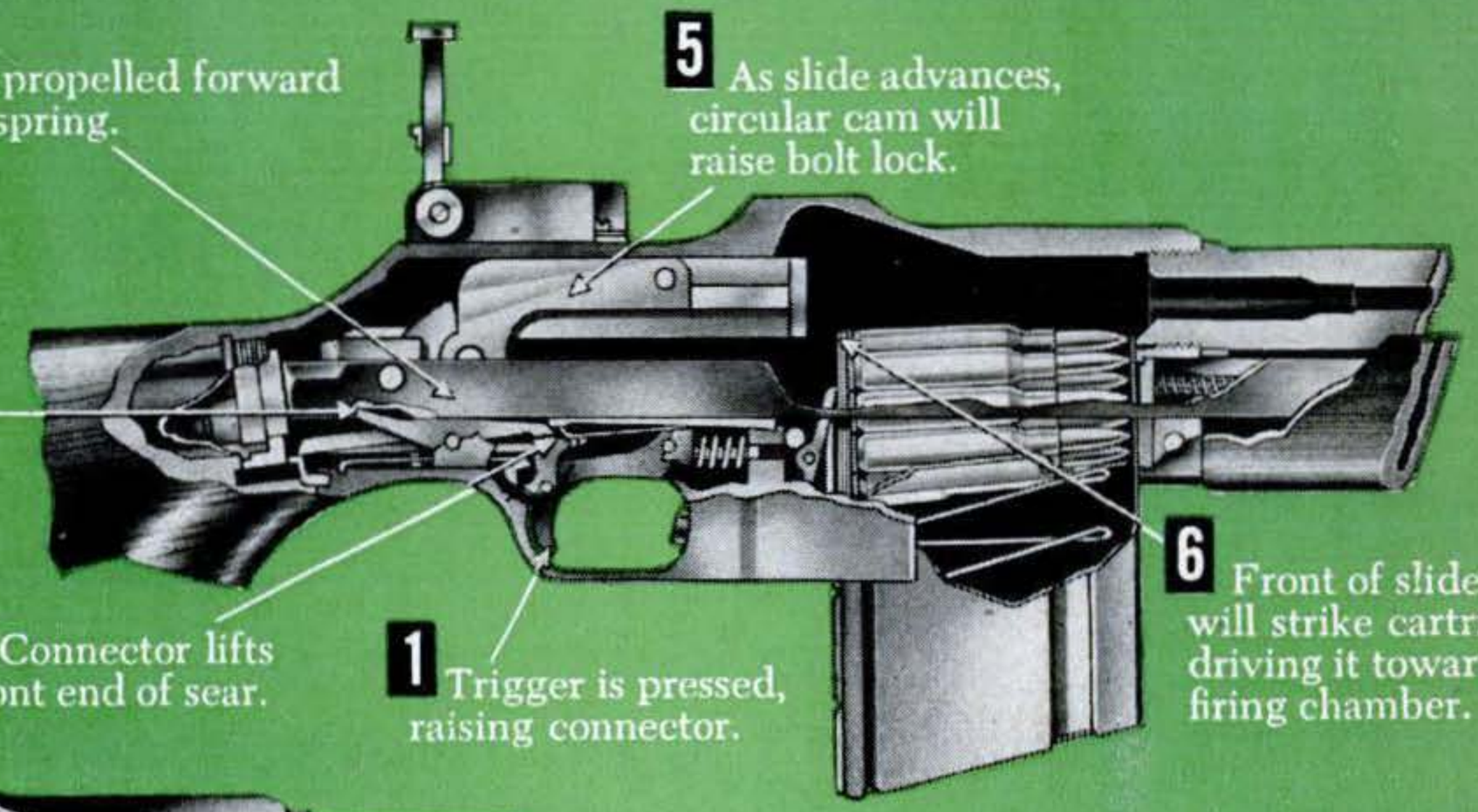
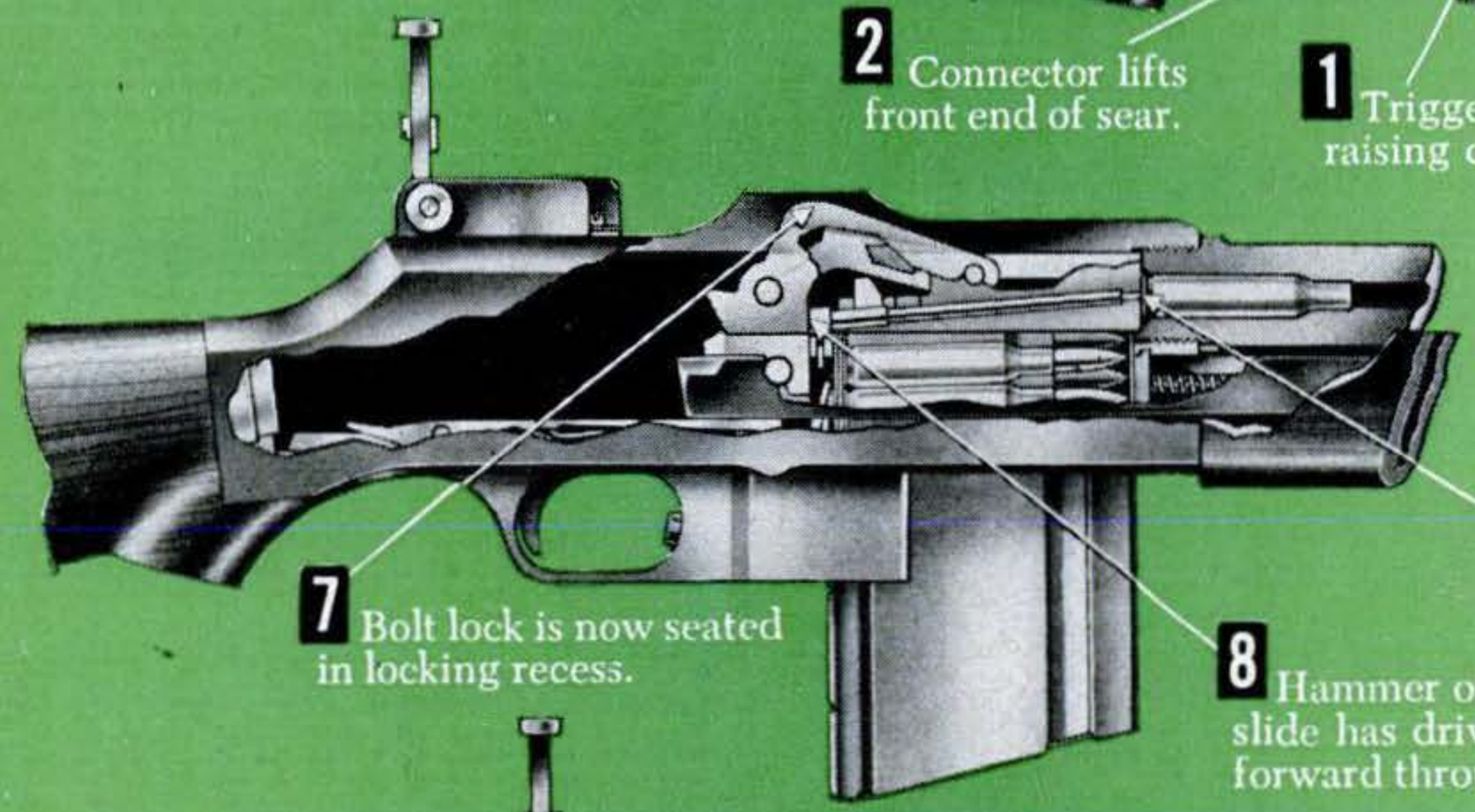
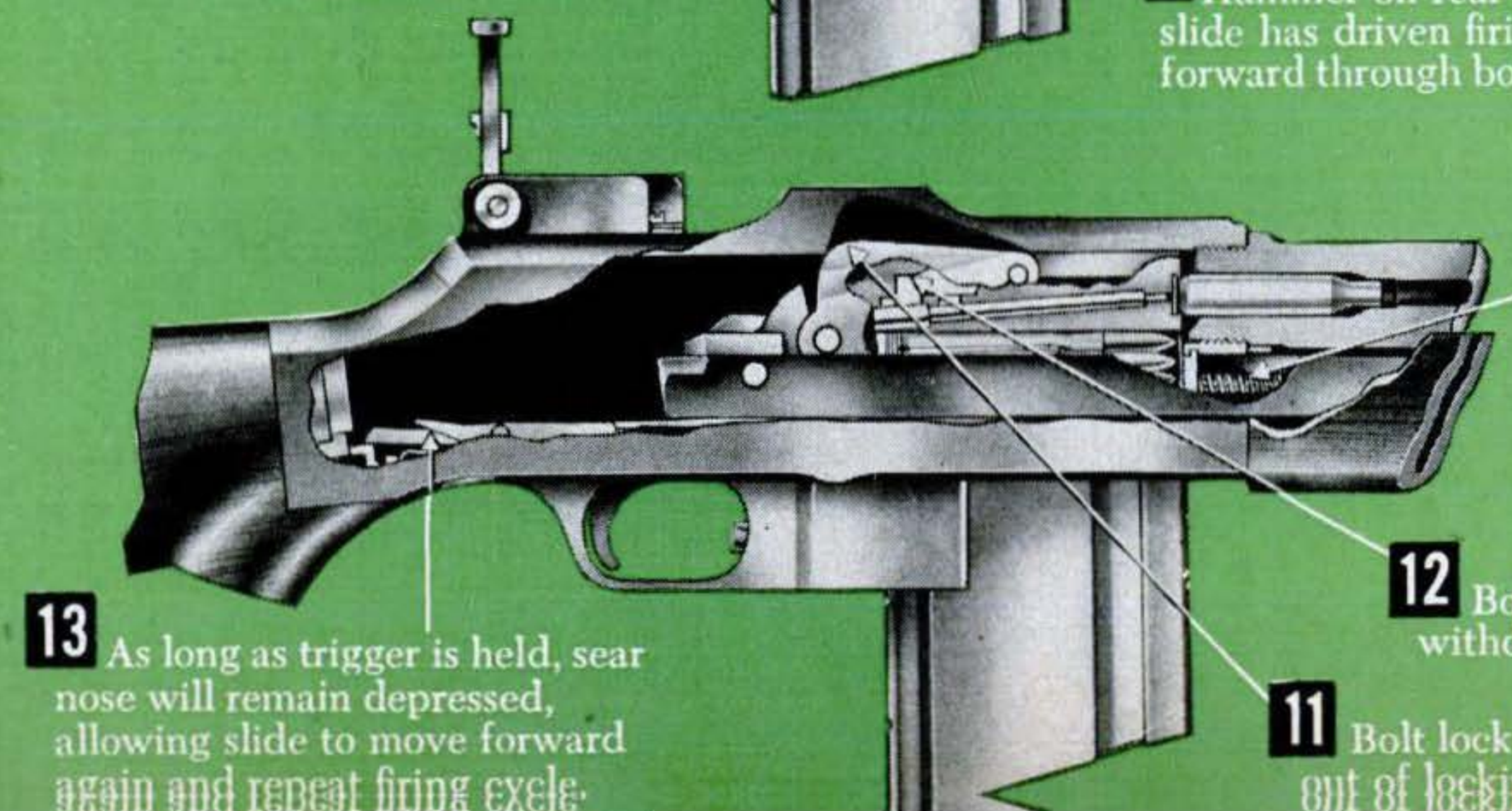


How the BAR Works

The Browning Automatic Rifle —known to the men who use it as the "BAR"—has been the Infantry's basic automatic support weapon ever since it was adopted by the Army back in 1917. Rugged, accurate and reliable under all field conditions, it fires a .30-caliber bullet (same as the Garand) at a rate as high as 600 rounds a minute. Modified and improved before and during World War II—the latest model has two fully automatic rates of fire—the BAR's fundamental design has remained unchanged. Its biggest drawback is its weight—complete with bipod and 20-round magazine it tips the scale at a hefty 21 pounds. Eventually it will probably be replaced by a new lightweight automatic rifle now under development.







Know Your Weapons

P.S.

Last minute news & notes...

BABY A-BOMBS, a revolutionary new weapon against troops in the field, are here. We have entered an era, says Chairman Gordon Dean of the Atomic Energy Commission, "when we can use atomic weapons tactically as well as strategically." Right now, we can employ these tactical A-weapons in "certain" military "situations." New types of A-bombs rapidly are multiplying these "situations." What all this means: No longer are large enemy cities the only feasible A-bomb targets--we can use small A-bombs more freely, and hurl them directly at troop concentrations. Of utmost significance, this could upset Kremlin calculations of the possibility of overrunning Europe by relying on sheer numbers of troops and conventional weapons like tanks.

EXTRA-HEAVY SNOWSTORMS will be predicted more accurately this winter over a 10-state area in the East, the U.S. Weather Bureau expects. One of its experts, Conrad P. Mook, has analyzed records of nearly 500 heavy snowstorms in the region and has found remarkably similar conditions of temperature, humidity and wind prevailing beforehand. By recognizing this weather pattern, it should be possible to forecast future deep snowfalls.

ADDING a new chemical, an organic phosphate, to aviation gasoline is reported to eliminate spark-plug fouling and consequent misfiring almost completely.

CHILDREN too young to swallow capsules of the bitter-tasting but lifesaving drug, Chloromycetin, may take a derivative of it in a creamy preparation pleasantly flavored like custard. Developed by Parke, Davis & Co., the children's form of Chloromycetin has been found effective in treating whooping cough, measles, mumps, typhoid fever and other bacterial and rickettsial infections.

GERM-WARFARE DEFENSE is one object of a newly created Epidemic Intelligence Service of the U.S. Public Health Service. In peacetime its medical officers will help fight epidemics beyond the control of local authorities. In time of war, they would be key men in detecting outbreaks of disease caused by an enemy and in identifying rare and unfamiliar diseases whose germs might be spread from the air, or by saboteurs.

BLACK EYES can be prevented more effectively with electricity than with beefsteak. Tests at a Northport, N.Y., hospital show that a 20-minute treatment called galvanism with a very small dose of current will forestall a shiner, if applied within an hour or so of the injury.

ANTIFREEZE for cars may be made from sugar beets. Canada's National Research Council reports that sugar-beet molasses, a by-product, can be converted by fermentation to butanediol, an antifreeze agent. The process awaits a sponsor willing to spend $2,500,000 to build a plant.

PROSPECTORS have found a deposit of quartz crystals suited for electronic equipment, the first discovered in this country, on a 9,000-foot-high Utah plateau. Hitherto the U.S. has had to depend on Brazil and other foreign sources for this strategic material. To stimulate development, the General Services Administration has contracted to buy the entire first year's output.

AMERICA'S 10 FAVORITE HOBBIES, according to an American Hobby Federation survey of 24,000,000 men and women, rank as follows in popularity: stamp collecting; collecting handmade American glass; do-it-yourself hobbies like building bookcases and cabinets; photography; needlework; gardening; autograph collecting; painting; and collecting buttons and dolls.

The Editors

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MECHANICS *and* HANDICRAFT
REG. U. S. PAT. OFF.

New Bright-Colored Stains Show Grain of Wood

Transparent but loaded with color, these new finishes create dramatic effects with natural wood grain.

By Darrell Huff

IF YOU like the good looks of natural wood grain, but still want the lift and warmth of color, you can get both with some unusual wood finishes that have recently appeared on the market.

In most cases these new products are quicker and easier to use than traditional finishing materials, since a single coat usually does the trick. Wood that is wild-grained or discolored, however, will require preliminary treatment, and for some effects a second coat may be desired.

Novel effects may be achieved with a new type of varnish stain made in sparkling shades of red, blue and green, and in black. It imparts a hard, weatherproof finish to the wood, coloring it brilliantly and intensifying rather than concealing the grain.

This varnish stain, Adelphi Color Grain,

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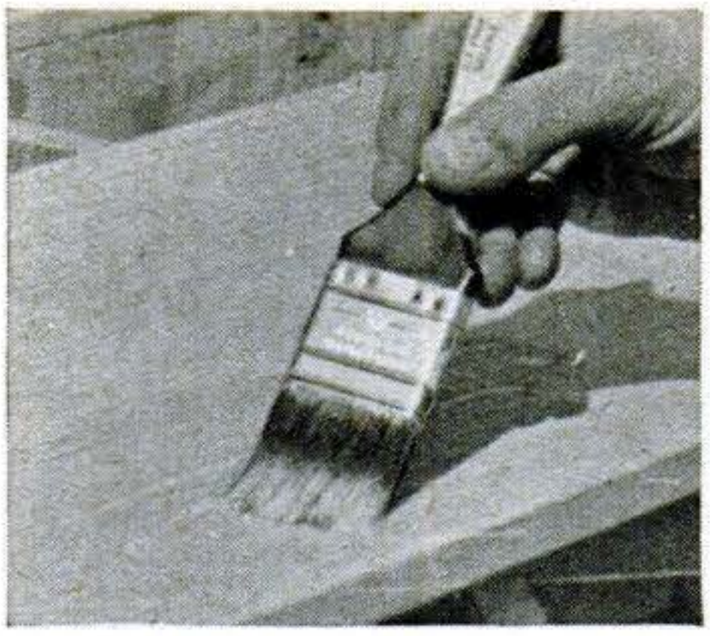
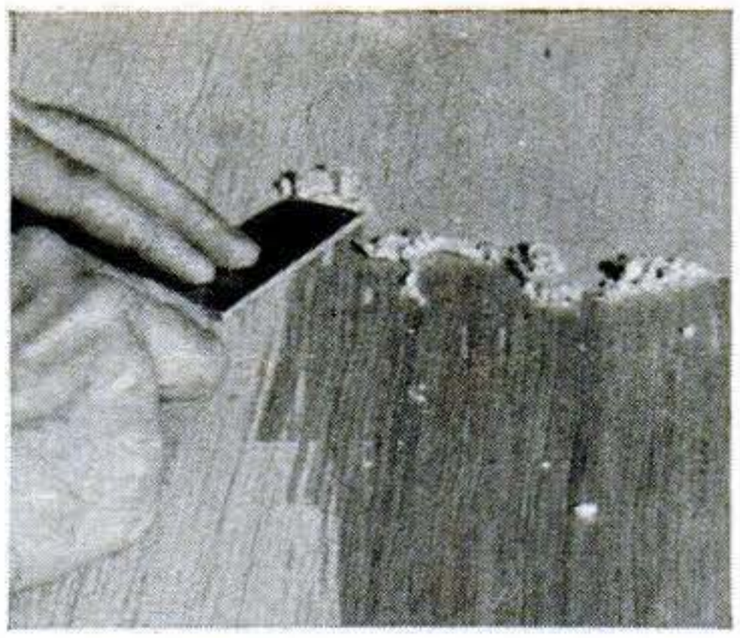


BRUSH ON foundation coat if needed. Thin it with turpentine or mineral spirits.



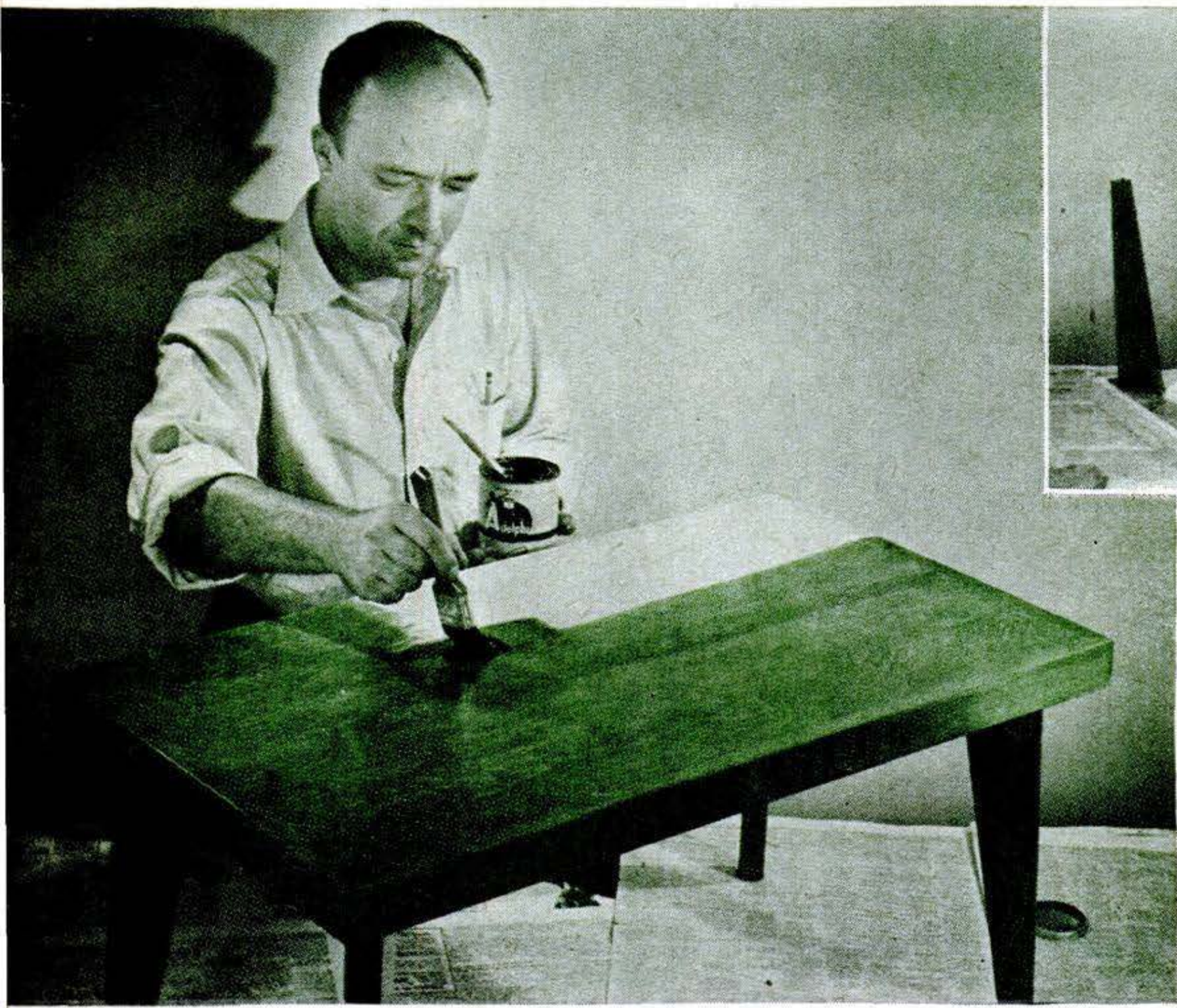
SCRAPE OFF EXCESS with a putty knife after it has dried for 5 or 10 minutes.

WIPE THOROUGHLY with cloth and let dry overnight. Work is now ready for color.

is brushed or wiped on the wood and allowed to dry overnight. At this point the job is usually ready for use. If a deeper color is desired, rub down lightly with fine steel wool and apply a second coat. If a high gloss is your objective, finish with a coat of clear varnish.

Occasionally you may come up against wood that is not well grained or wood that is pitted with imperfections. Here a foundation coat will improve the end result. The foundation coat, a type of filler, is brushed on and allowed to set for five or ten minutes. The excess is scraped off with a putty knife and the job then wiped with a clean cloth. After letting it dry overnight, finish with the color varnish in the same manner as for bare wood. Because of its weather-resistant quality, this finish is equally suited to your front door, floors, basement bar or unpainted furniture. Old pieces can be colorfully refinished by removing the old finish and sanding smooth.

Another product, also designed for simplicity of application, is a liquid stain wax available in wood colors like maple, redwood, mahogany and walnut, as well as blond, gray, ivory and white. I've been using Cabot's Stain Wax, but there are several others to choose from that are similar.



AFTER SANDING WORK clean and smooth, apply Color Grain with a brush or rag. Note the effect of the brilliant green stain on the wood grain. Start with legs, as shown in photo above.

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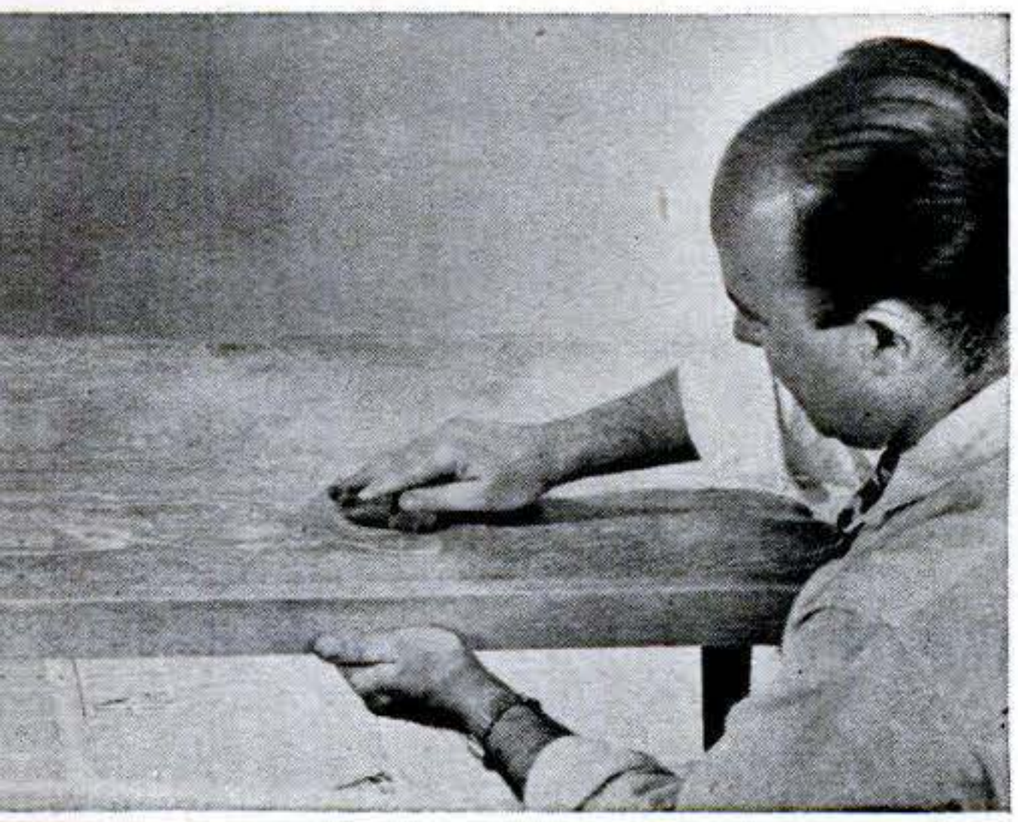
COAT OF RICH RED STAIN is brushed on a companion table. One application is usually all that's needed, although a second coat will add gloss and deepen the color.

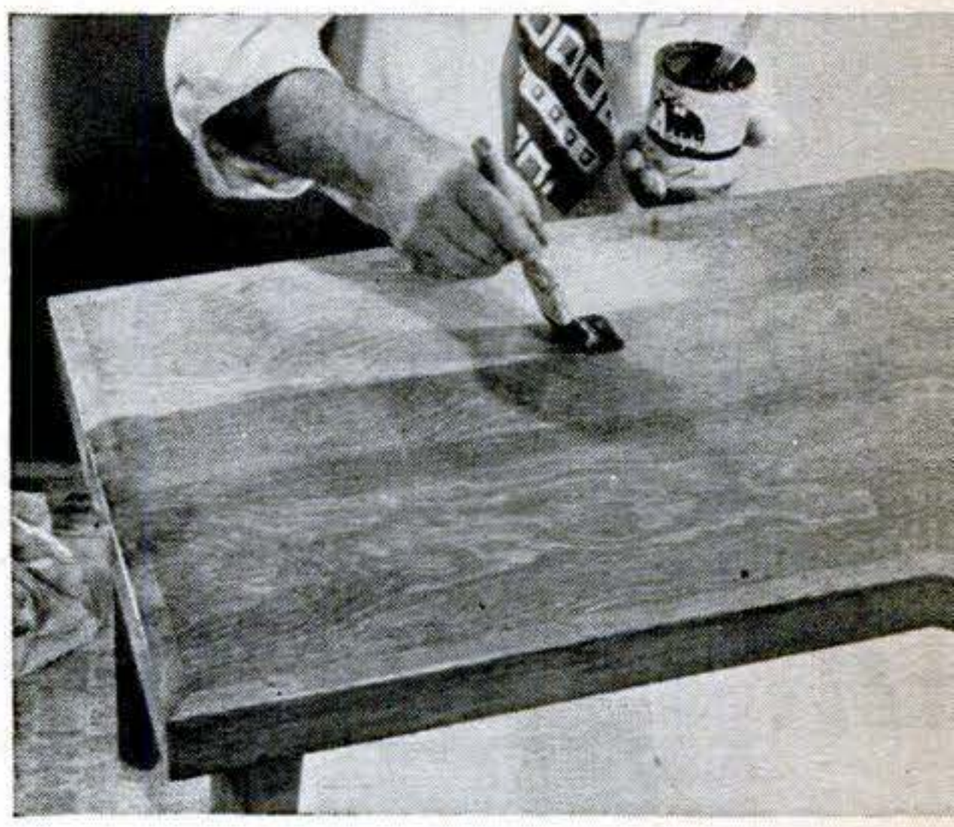
This liquid stain wax penetrates deep into the pores of the wood, producing, in one operation, the rich color of stain with the soft luster of wax. It is applied to the bare wood with a brush or rag. Allow it to set two to ten minutes and rub with a cloth, using a rotary motion to work the pigment into the grain and leave an evenly stained surface. If additional luster is desired, let the first coat dry overnight and then apply a coat of natural liquid wax and polish briskly. END

Next month Edwin M. Love tells how to use patterns and jigs in your woodworking.



USE FINE STEEL WOOL to rub first coat, as at left. If the color is satisfactory, finish with a clear varnish to add gloss.

IF COLOR IS LIGHT, a second coat will add depth and gloss. In either case, finish by rubbing with steel wool and polish with soft, dry cloth.



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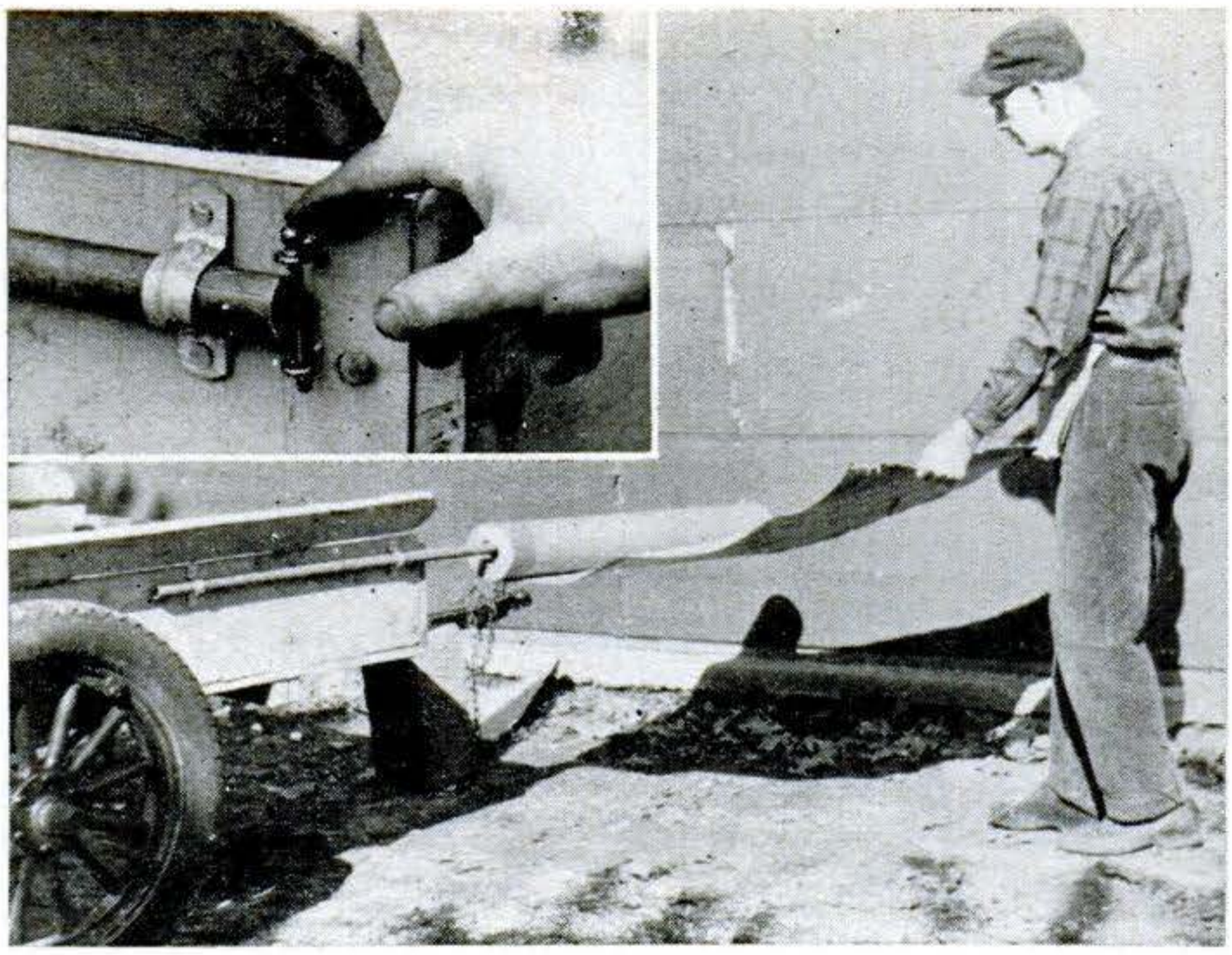
Pipe Roller Helps with Building Paper

HANDLING rolls of building paper on the ground is awkward, especially if only one man is at work. One builder solved the problem by attaching a ¾″ pipe to his pick-up trailer with pipe straps. The pipe is pulled out for use, the roll of paper slipped on and unrolled to desired length for cutting. A block of wood at one end and two eyebolts and a hinge pin at the opposite end anchor the pipe to the trailer.—*D. J. Murphy, Springfield, Mass.*

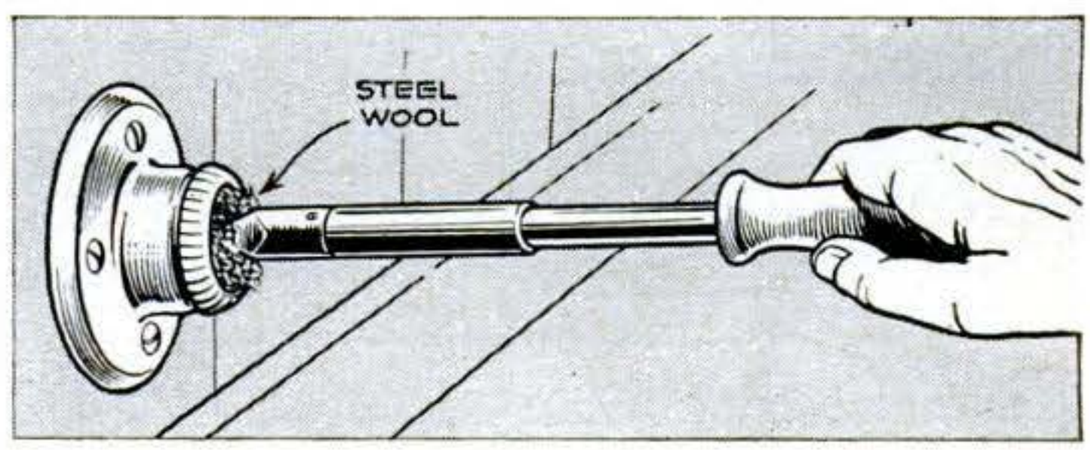


Old Lead-In Insulates Splice

WHEN you join two lengths of flat-ribbon television lead-in, use insulation from another piece to cover the joint. After you have twisted and soldered the conductors, light the end of the discarded lead-in. As the plastic melts, let it drip onto the exposed wire. It will make a more durable and weatherproof cover than tape. —*P. Casperson, El Cajon, Calif.*

Steel Wool Aids Soldering

A BROKEN electric-light socket mounted on a workshop wall and filled with steel wool is handy for keeping a soldering iron clean. Press the tip into the steel wool periodically to remove the excess flux that causes burning.—*John J. Rea, Urbana, Ill.*

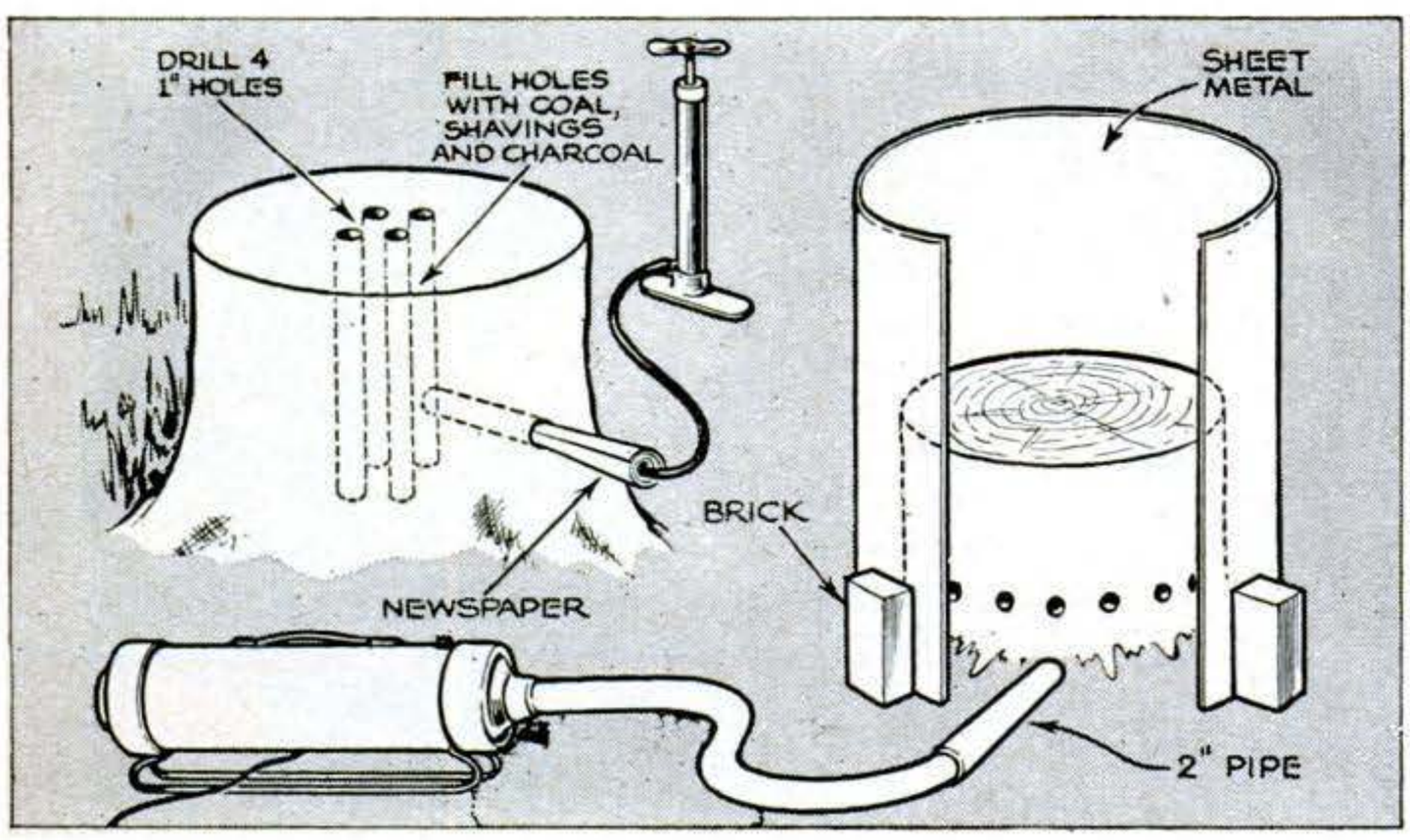


Forced-Draft Fires Destroy Stumps from the Inside

DAYS or weeks are often needed to burn out a stump with a fire built around it, but by getting the fire inside, you can sometimes do the job in hours.

Pictured below are two ways of doing this. Bore four 1″ holes down the center of the stump. Then drill a 1″ hole in the side, facing into the wind, to connect with at least one vertical hole. Rolled-up newspaper will serve as a pipe to connect a tire pump to the draft hole. After placing shavings, charcoal and coal in the vertical holes, pour in kerosene or crankcase drainings. Light the fire and pump gently until the newspaper pipe burns away.

Another method is to bore a dozen or so holes through the stump about 2″ above the ground. Six or seven bricks and a piece of sheet metal will make a crude furnace. To feed air to the fire, use a fan or vacuum cleaner.



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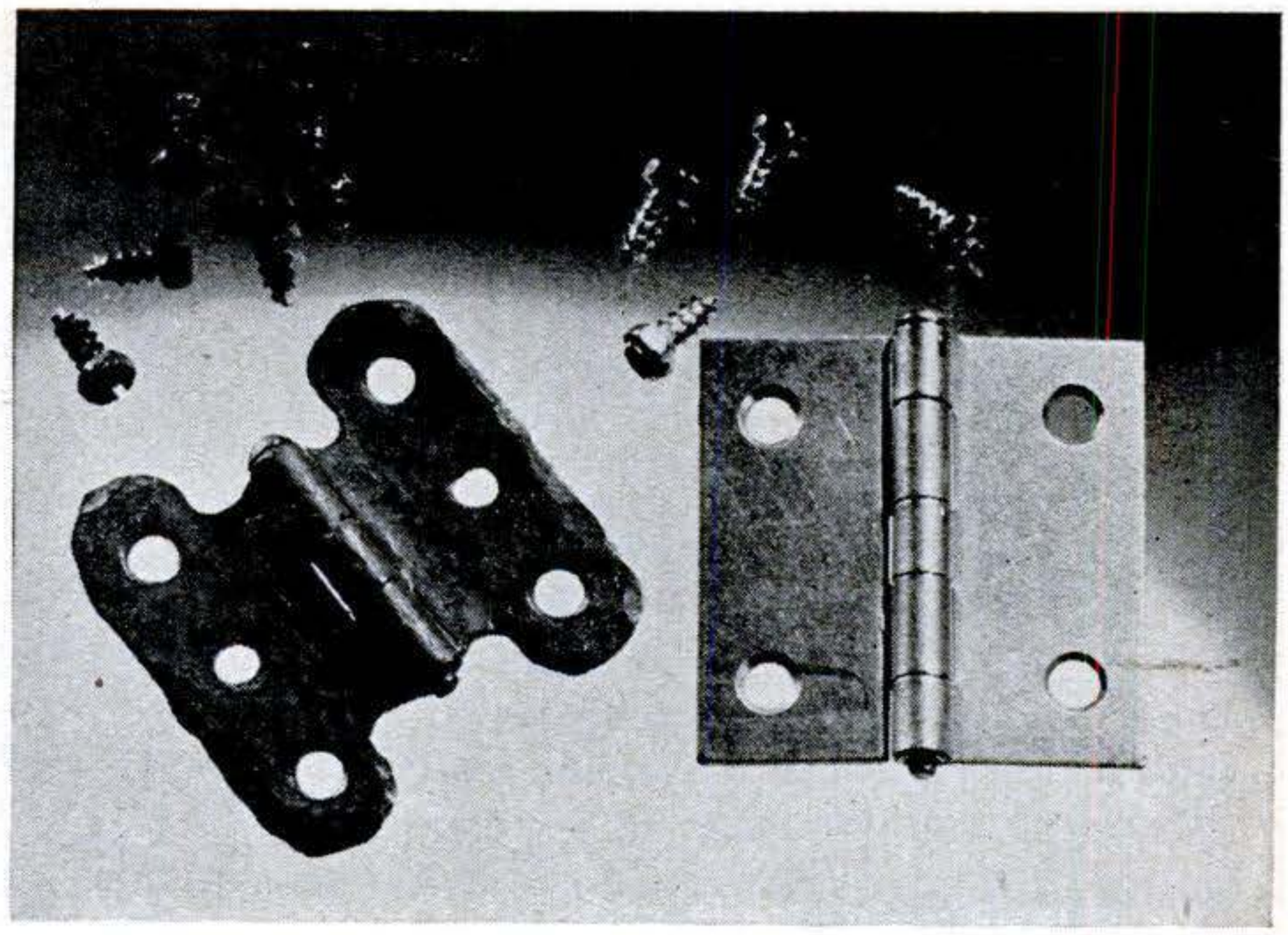
Old-Style Hardware from New

Colonial hardware can be made from stock hinges with a few hand tools.

By C. Strickland



THE hardware store in your neighborhood has the basic materials for Colonial hardware that looks like the real thing.

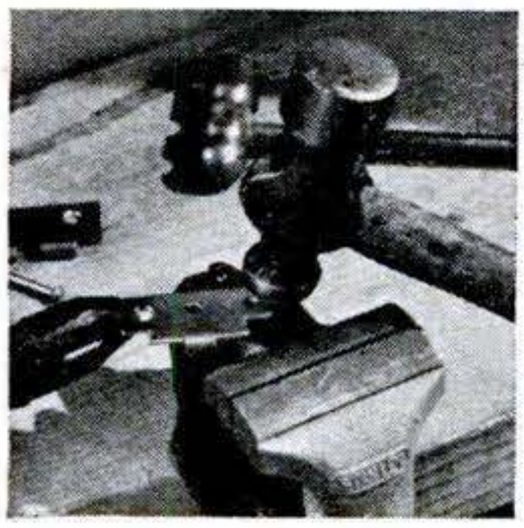
In the early days of this country, the craftsmen beat pieces of iron to shape for hinges and latches. Today, you can take an ordinary steel butt hinge and, with a ball-pein hammer, a hacksaw—and sometimes a drill—make excellent imitations of their efforts.

The drawings and photos show you a few examples. Your needs and imagination will suggest more.

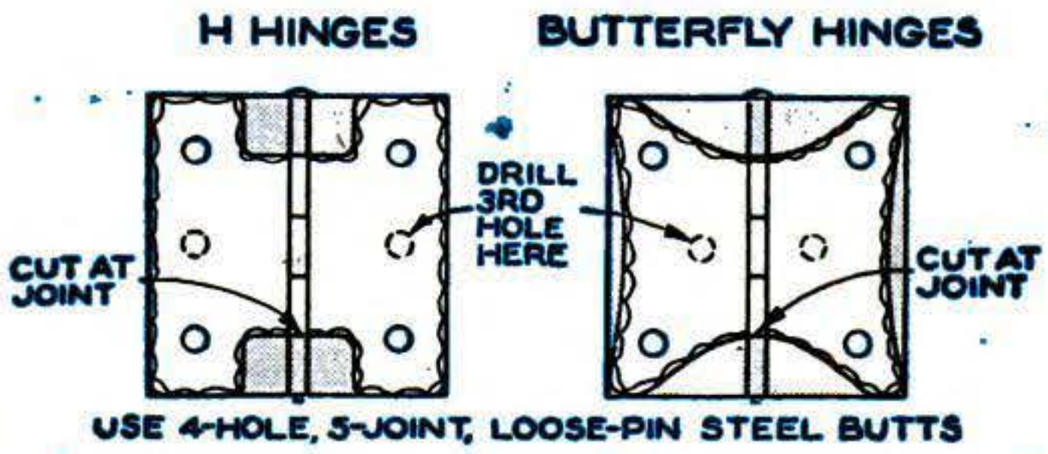
Select loose-pin hinges with five joints, if possible. Some types aren't made with five joints. In that case, cut them off at the center of each end joint, as shown here.

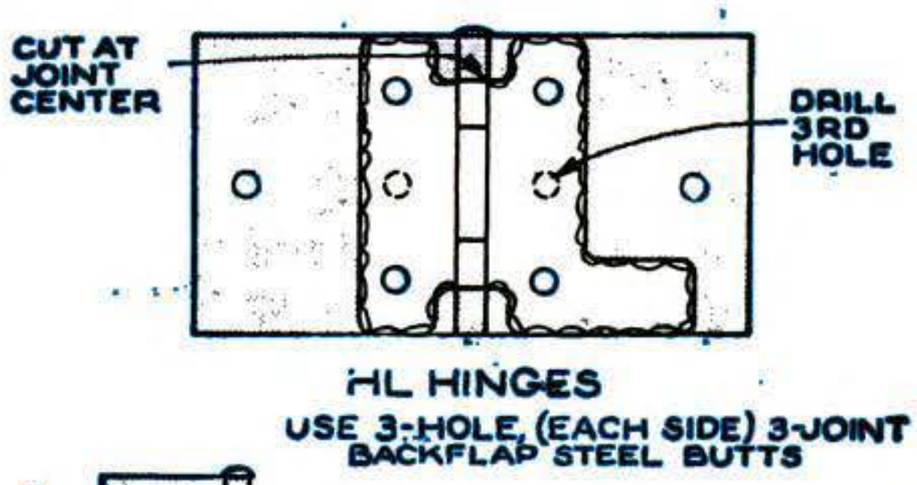
Take the leaves apart and shape them with a hacksaw and file. Then hammer them with a ball-pein hammer, paying particular attention to the edges. If you hammer near the joint, insert the pin so the pin loops won't be flattened. Then cut the pin to the new length and assemble the leaves. Apply metal primer and flat-black paint.

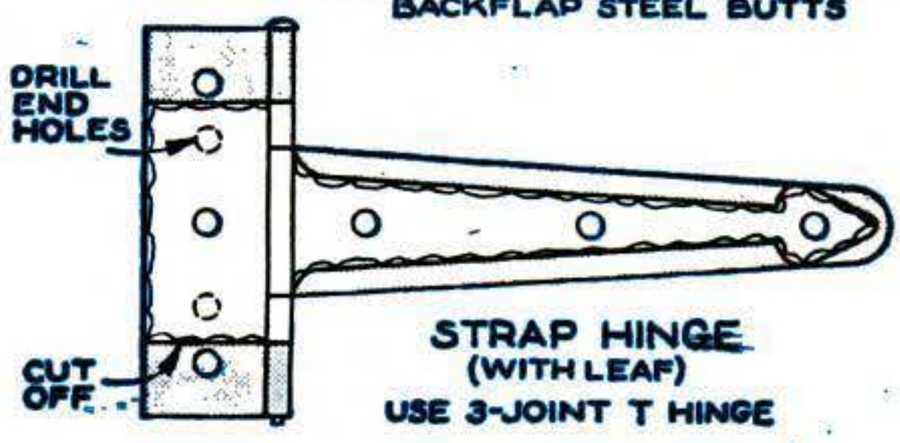
For screws, buy hex-head, sheet-metal screws from a radio-parts supplier. They will hold in wood and look well with Colonial hardware.

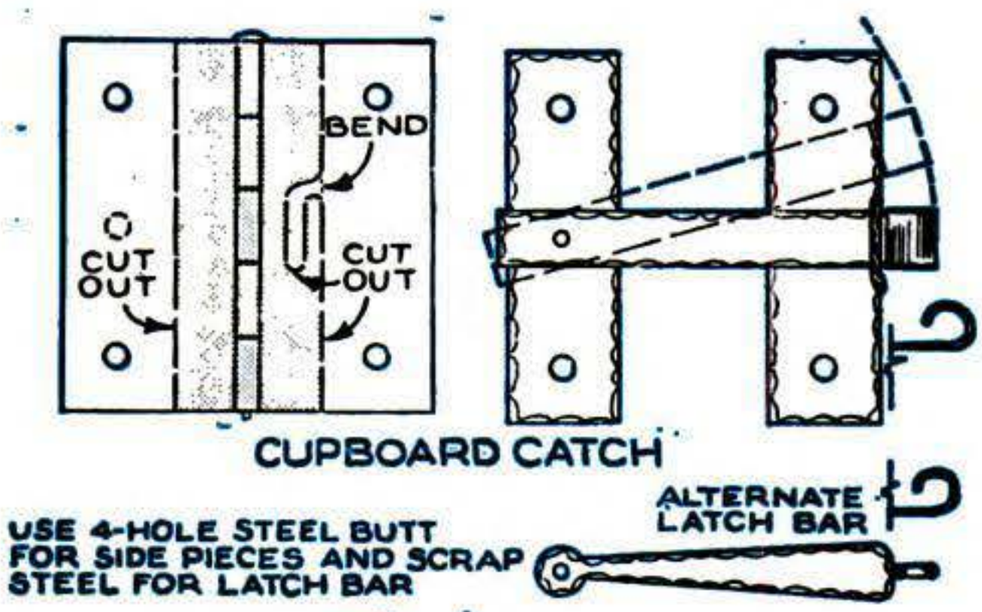


BEAT HINGES with a ball-pein hammer (left) after you saw them to size. Be careful not to damage the pin loops. Drawing at right shows you designs for four Colonial hinges and a cupboard catch.









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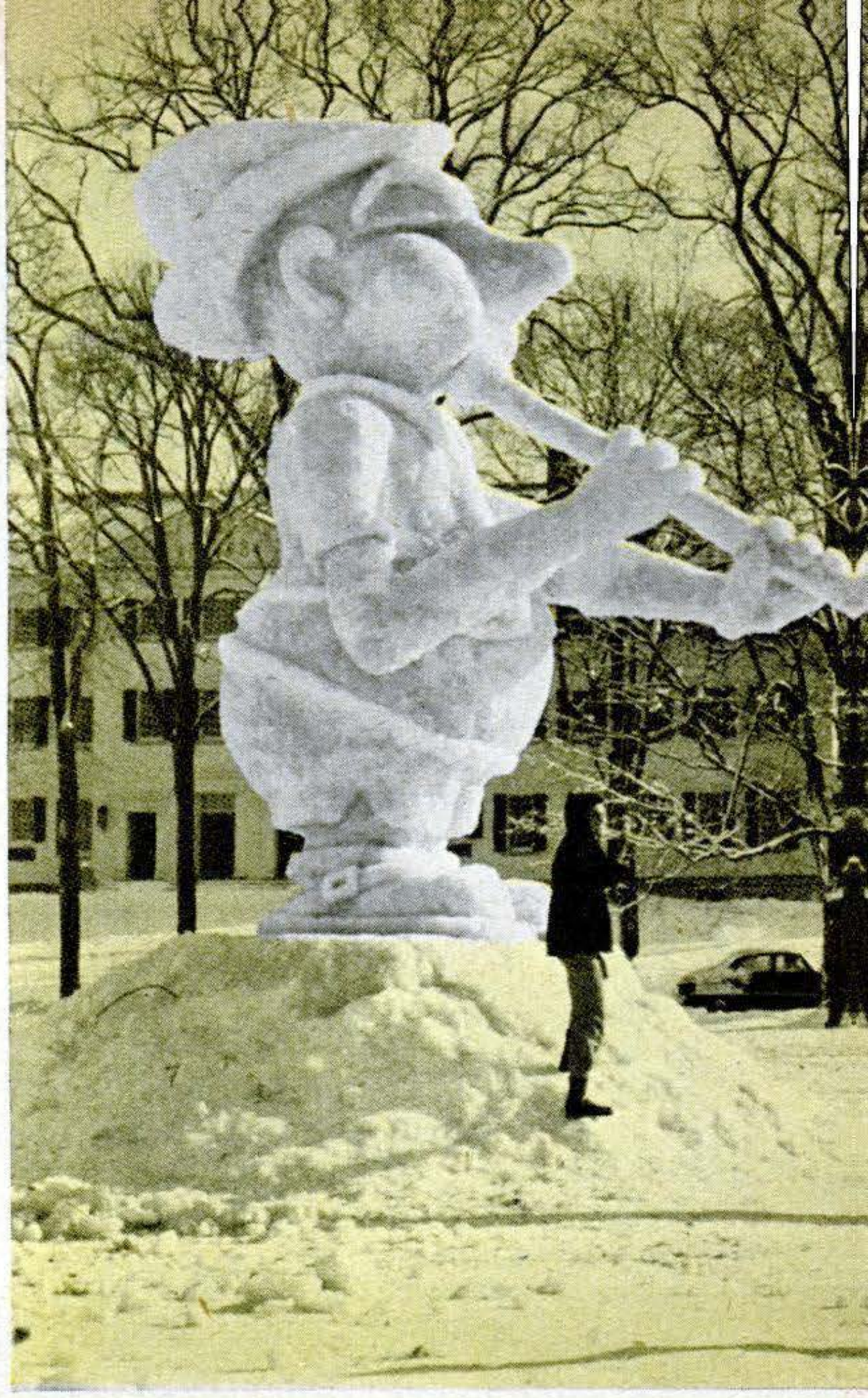
How the Experts Build a Snow Man

Their big, fancy snow sculptures take a lot of work, but you can copy them on a smaller scale in your yard.

By Carol Ennis

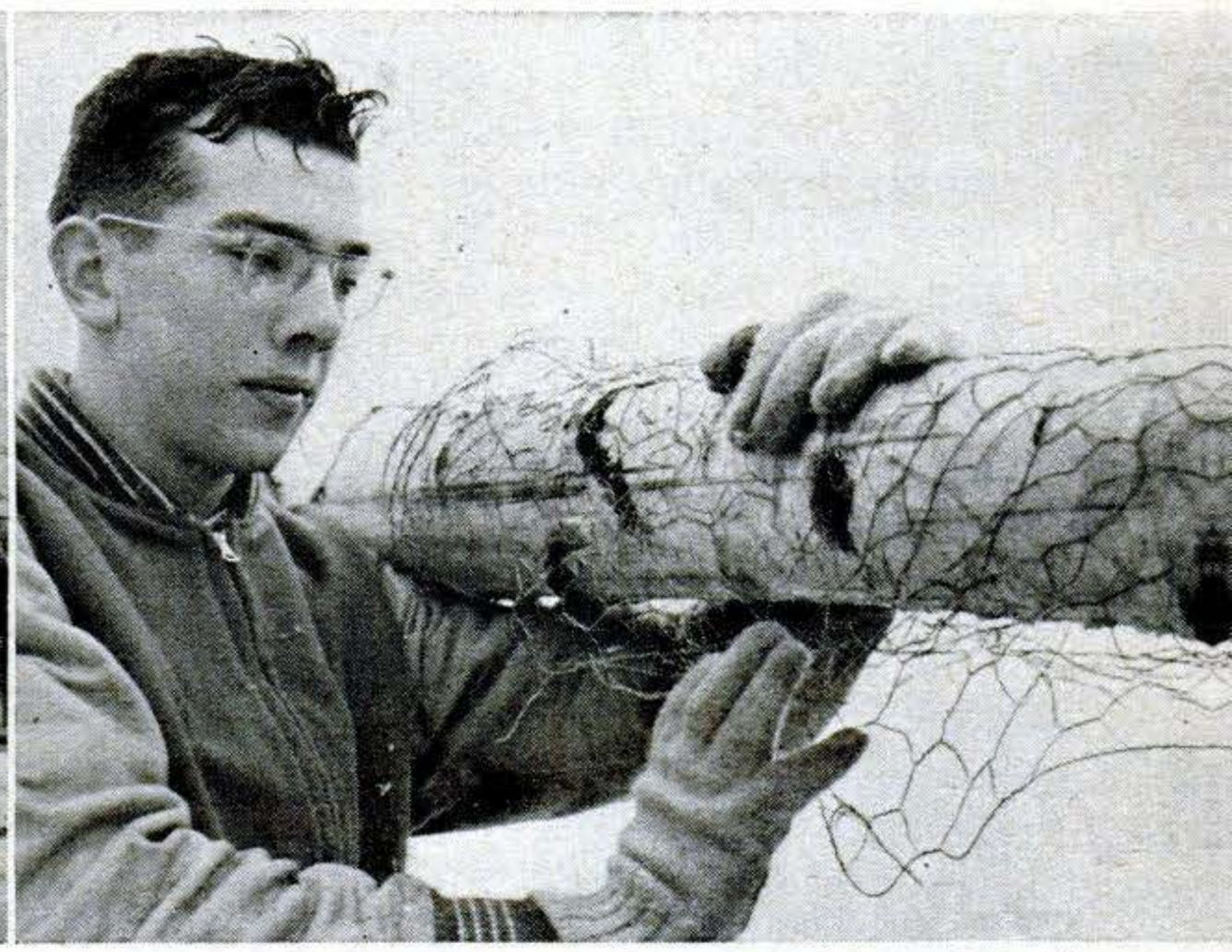
BUILDING a snow giant like this one is a real construction job that crews of students tackle every winter at Dartmouth College for the school's Winter Carnival. They begin by erecting a framework around which the statue is molded. A separate scaffold gives working platforms at several levels. Snow mixed with water forms slush for shaping the statue. The job takes the crew about three weeks of spare-time work.

For your yard this winter, you can build a small version of this Alpinist and his horn. If the scale is modest, the statue won't be as much work.



Snow man 24′ tall blows a 43′ horn. Big statues

SHAPING THE FORM with pickaxes, students work on the scaffold. Snow and water are mixed to form slush, which is hoisted to workers who plaster it on the figure in below-freezing weather. Top of birch log that makes central armature can be seen rising above statue.



CHICKEN WIRE is wrapped around another birch log that forms center of the horn. Slush is then plastered on log. Use of wire makes it easier to get the slush to stick until it has frozen. Bulging sections of statue, such as hat and nose, also are formed over wire.

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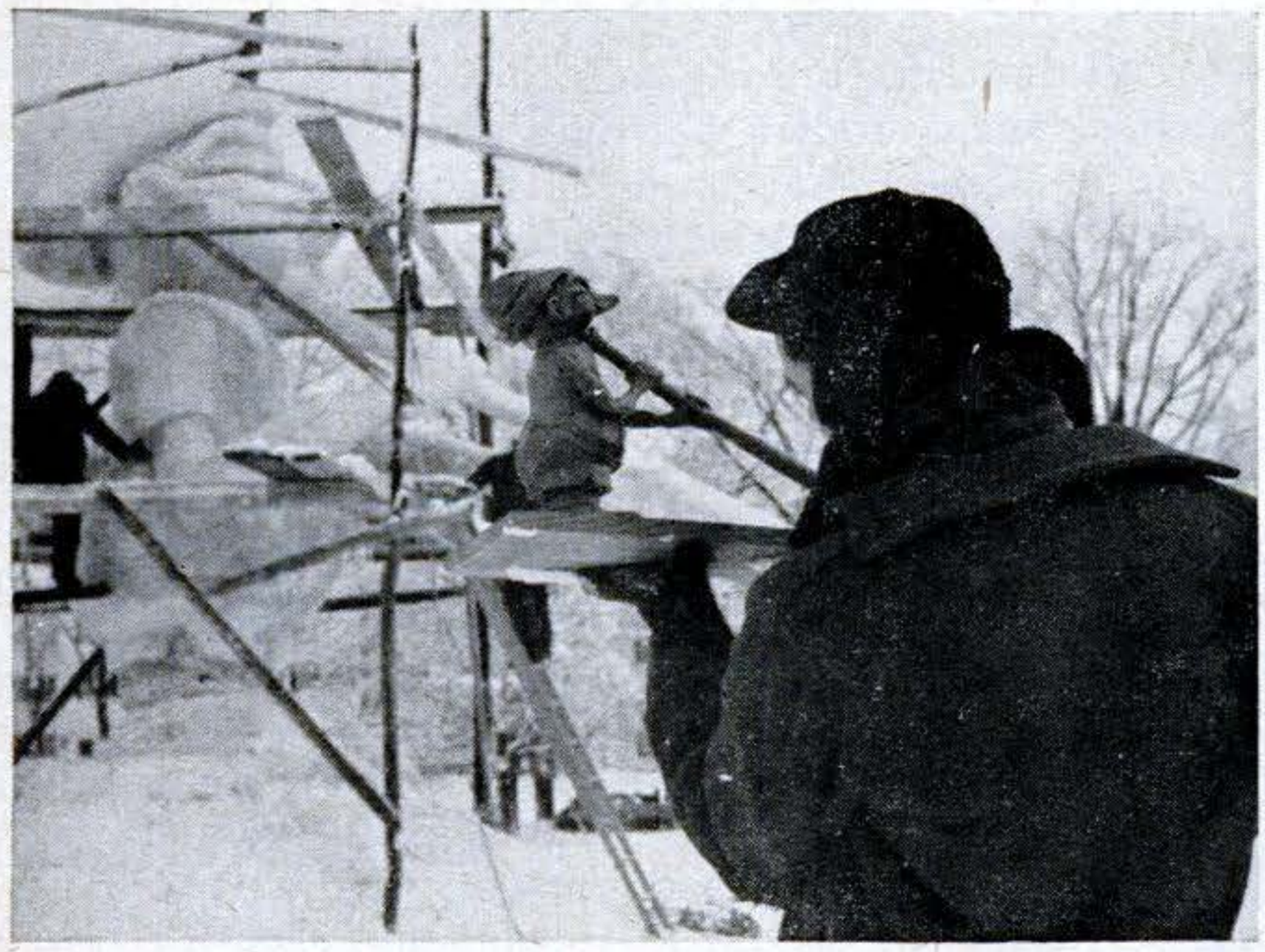
like the one above require a rigid log frame inside to support and strengthen the frozen slush.



CLAY MODEL of the statue—made before work on the big one was started—is compared with the full-scale job as work progresses. Winning design is selected in contest held before the Winter Carnival. You won't need a model with smaller statue if your eye is good.

DECORATIVE DETAILS are carved with kitchen ice chippers. Student is working on one of the shoe buckles in photo above. Completed statue is then sprayed with water from head to toe. The water freezes to a shiny coating, giving the statue a sleek, glossy appearance.

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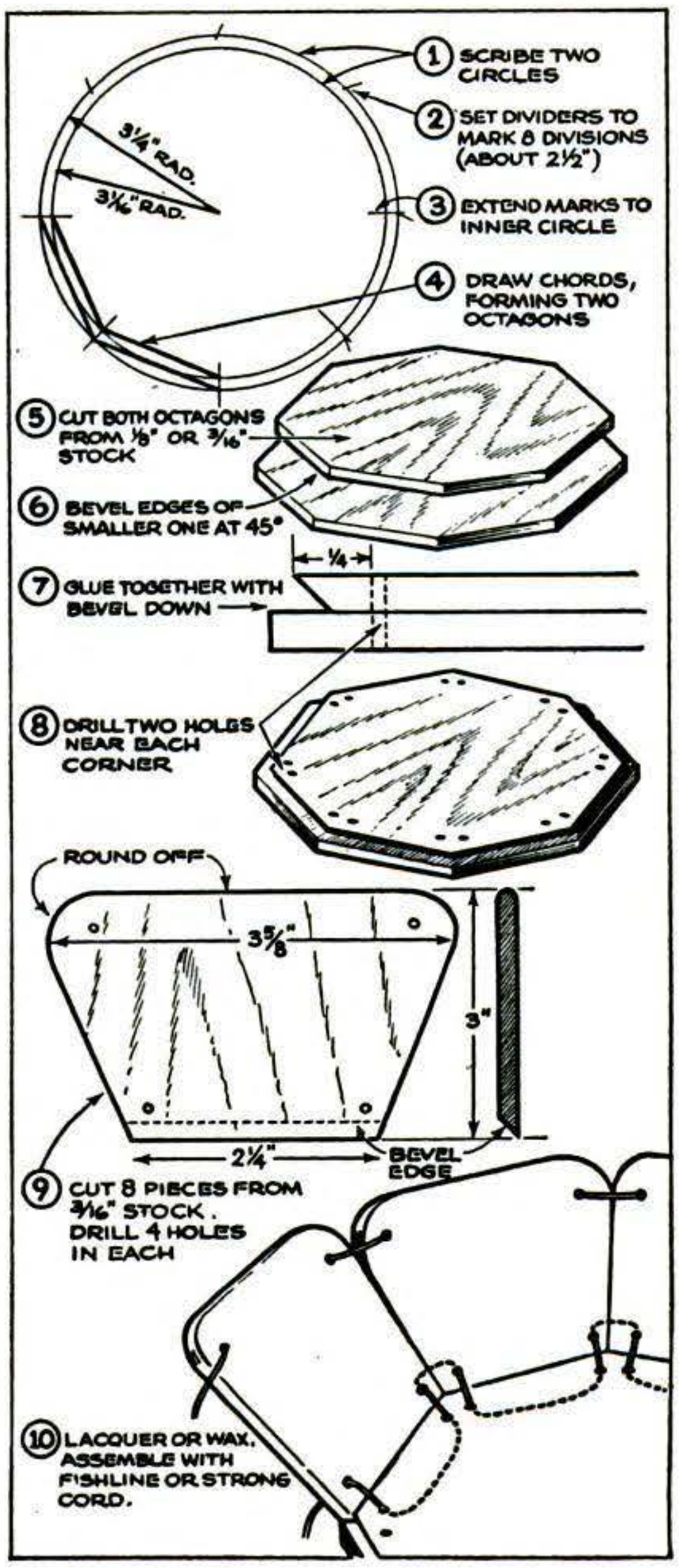
Wooden Bowl Is Tied Together

THIS unusual bowl came from the Holy Land and was evidently made by hand of a native hardwood. It is a rewarding project for the craftsman with few tools. If you plan to make Christmas gifts, this deserves a place on your list.

Numbered steps in the drawing show how it can be made by gluing up the base of two pieces, which saves the work of undercutting a single one. The edges of the smaller piece can be beveled by filing or carving, if no power tools are available. The bottom edges of the eight sidepieces are similarly beveled.

Drill all the holes and finish the parts before putting them together. On hardwood, a wax finish will be attractive. If painted decorations or decals are used, protect them with clear lacquer. Use a single length of cord to join the pieces to the base, and individual short pieces to tie them together at the top.



Paintings on Ice Decorate Back Yard Skating Rink

JOHN LYSFJORD and family of Robbinsdale, Minn., skate in their own back yard. Whenever three or four inches of snow falls and the temperature drops to freezing, they bank snow around the edges of the yard to form a rink. The skating surface is sprayed sparingly with a hose until the water is ½" deep. Too much water used at once produces spongy, porous ice. After this first layer of water has frozen, more is added to form a second layer. During spraying operations, the hose must be kept running constantly. If turned off intermittently, the water will freeze unevenly.

The Lysfjords paint stars, scrolls and flowers on the ice, using a stiff-bristled brush and show-card colors diluted with two or three parts water. The colors freeze almost instantly and are protected by spraying again lightly.

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Twelve Steps to Carving a Sweet Smoking Pipe

Make it in your shop and smoke it. You don't need a lathe, and the material may come from your own back yard.

By Erwin S. Koval

A HAND-CARVED pipe, finished without varnish or other synthetic substances, smokes as brier was meant to be smoked. You'll find both a smoker's pleasure and a craftsman's satisfaction in making yourself one. If you don't use a pipe, it still makes a fine gift for someone on your Christmas list.

All you need for materials is a block of brier and a stem, or a bit of Plexiglas to make one from. Hobby shops usually stock these items. Although imported brier affords the most pleasing grain, you can make a good pipe from well-seasoned apple, cherry, or other curly-grained wood.

The design is in your hands. You can create an original pipe, copy an old favorite, or work from a picture. First make a clear sketch to lay out on the block of wood you have selected. Then follow the steps shown on the next two pages.

Please turn the page for 12 more photos.

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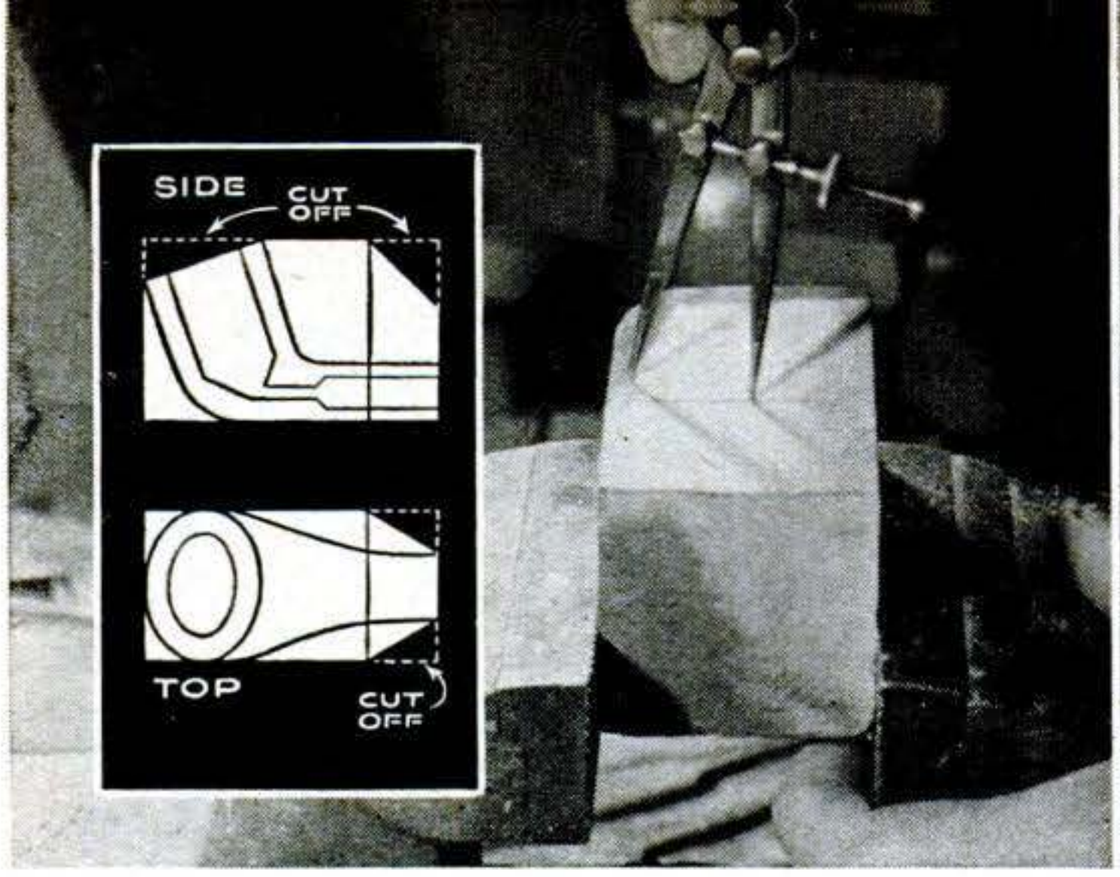
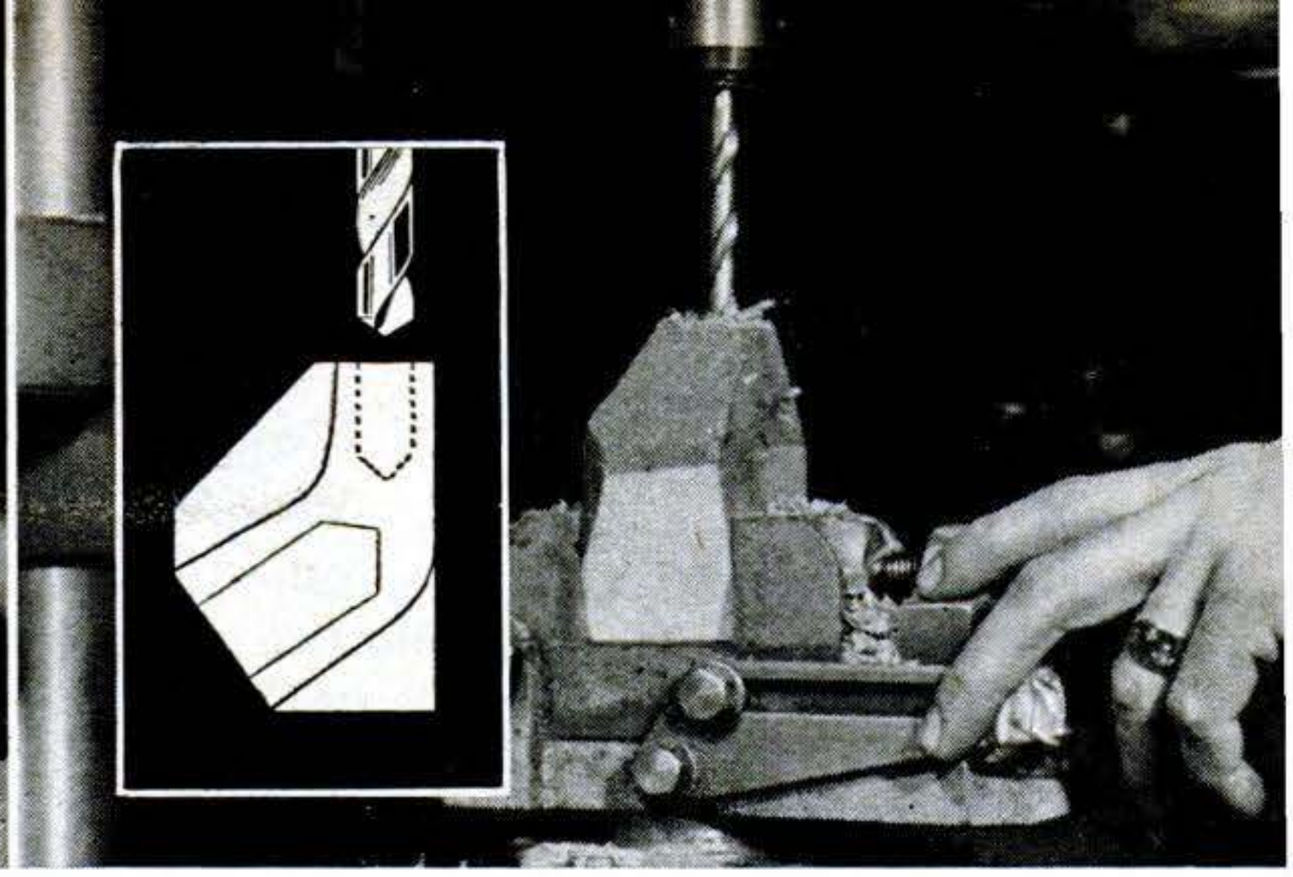
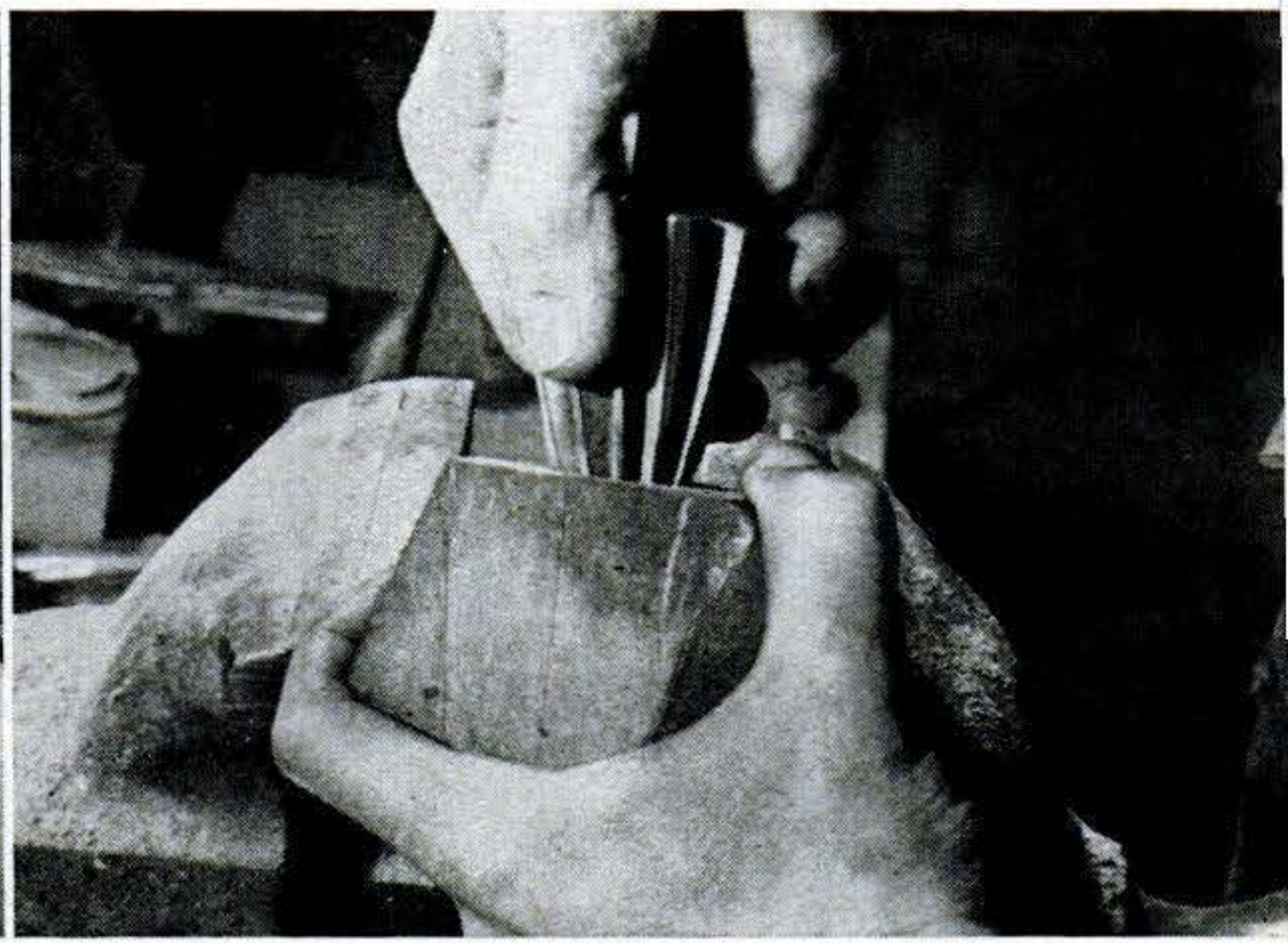


1 SQUARE UP A BRIER BLOCK. Cut off top and two side corners at the shank end, and top corner above the bowl. Scribe the side and top profiles, using dividers for the bowl.



2 CLAMP THE BLOCK, shank end up, for drilling the stem hole. Drill to a size you can ream to a push fit for the stem, and to a depth ½″ from the bowl cavity, as marked.

5 REAM THE STEM HOLE, with either a reamer or another drill, to a push fit for the stem. You can buy the stem, salvage one from an old pipe, or make one as in step 7.



6 FLARE THE BOWL with a plumber's pipe reamer, if you have one. It does a quick job. You can also use a carving burr in a hand grinder, or a file and sandpaper.

9 TO SHAPE THE INSIDE CURVE between bowl and shank, use a file, or a big burr in a hand grinder. The sponge-rubber block in the vise above makes a good rest for the job.

10 FILE THE SHANK FLUSH with the stem all around, and remove burr marks. Keep the shape true and symmetrical. Then sand, unless you want a gnarled effect.

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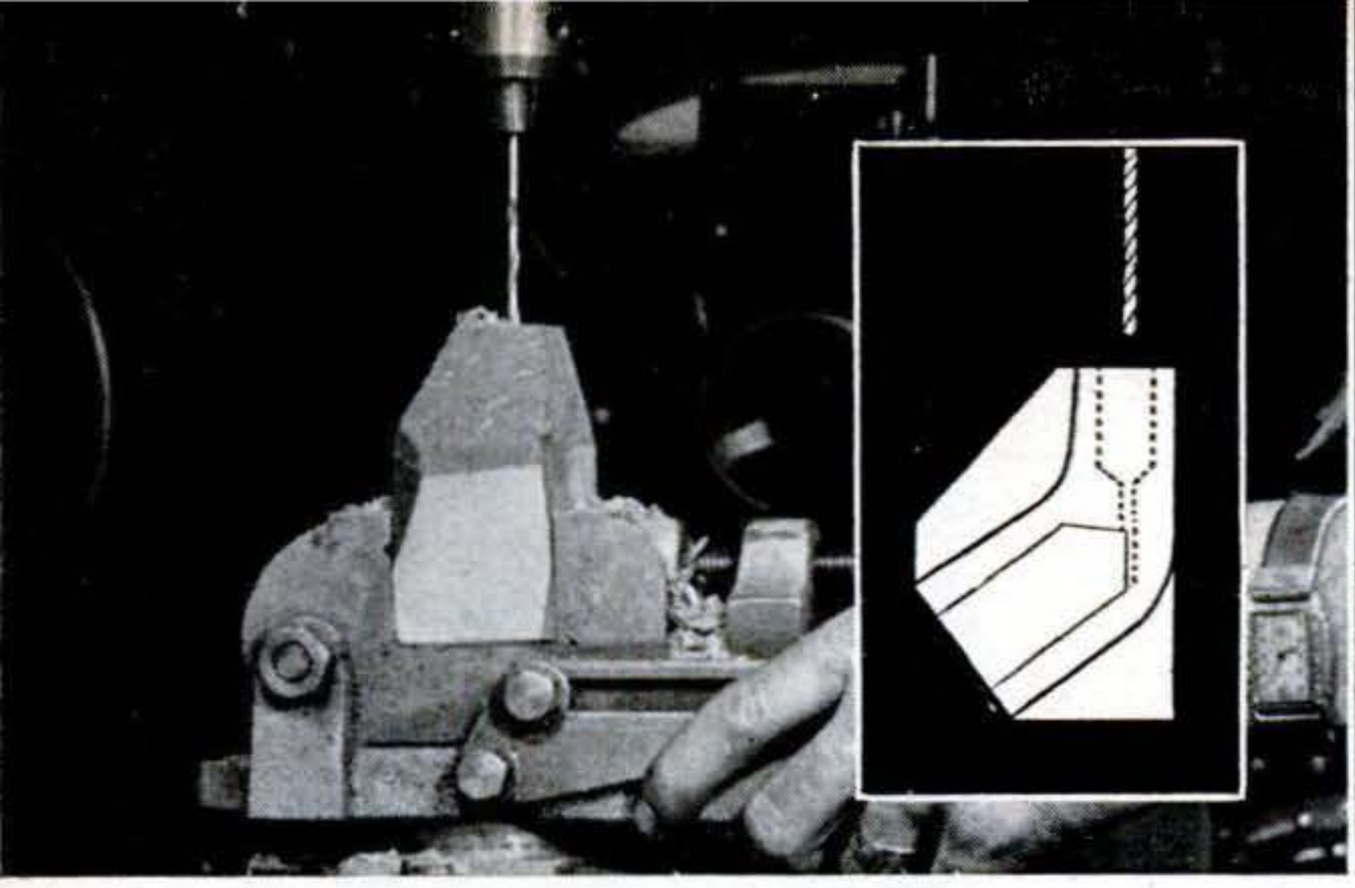
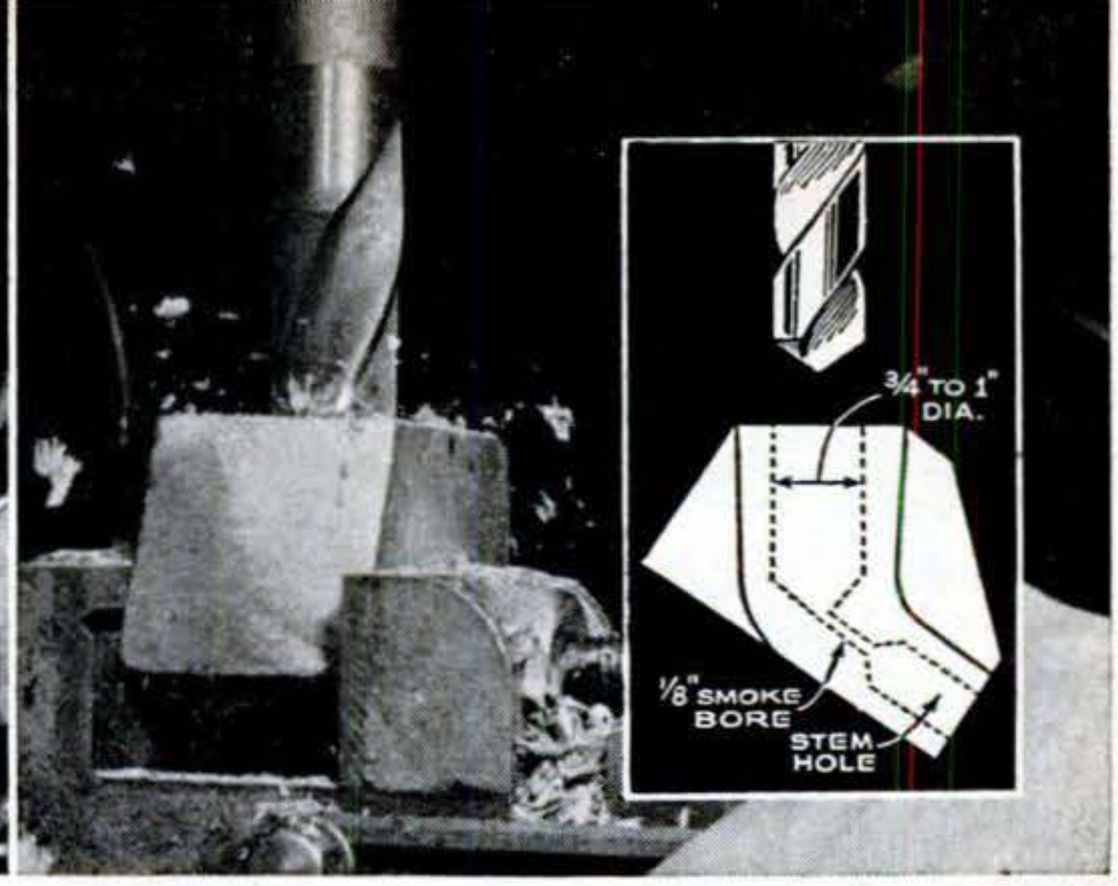
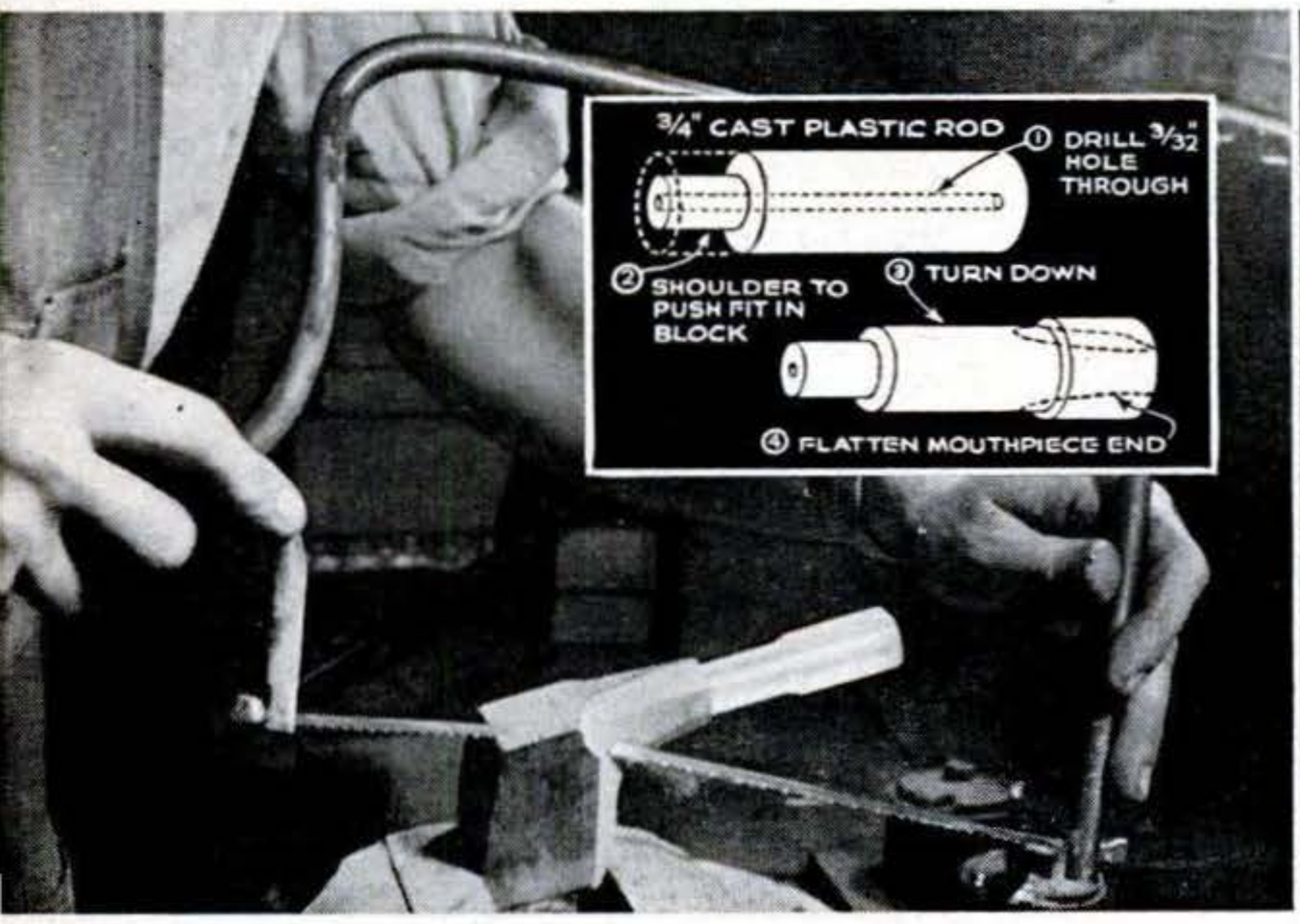


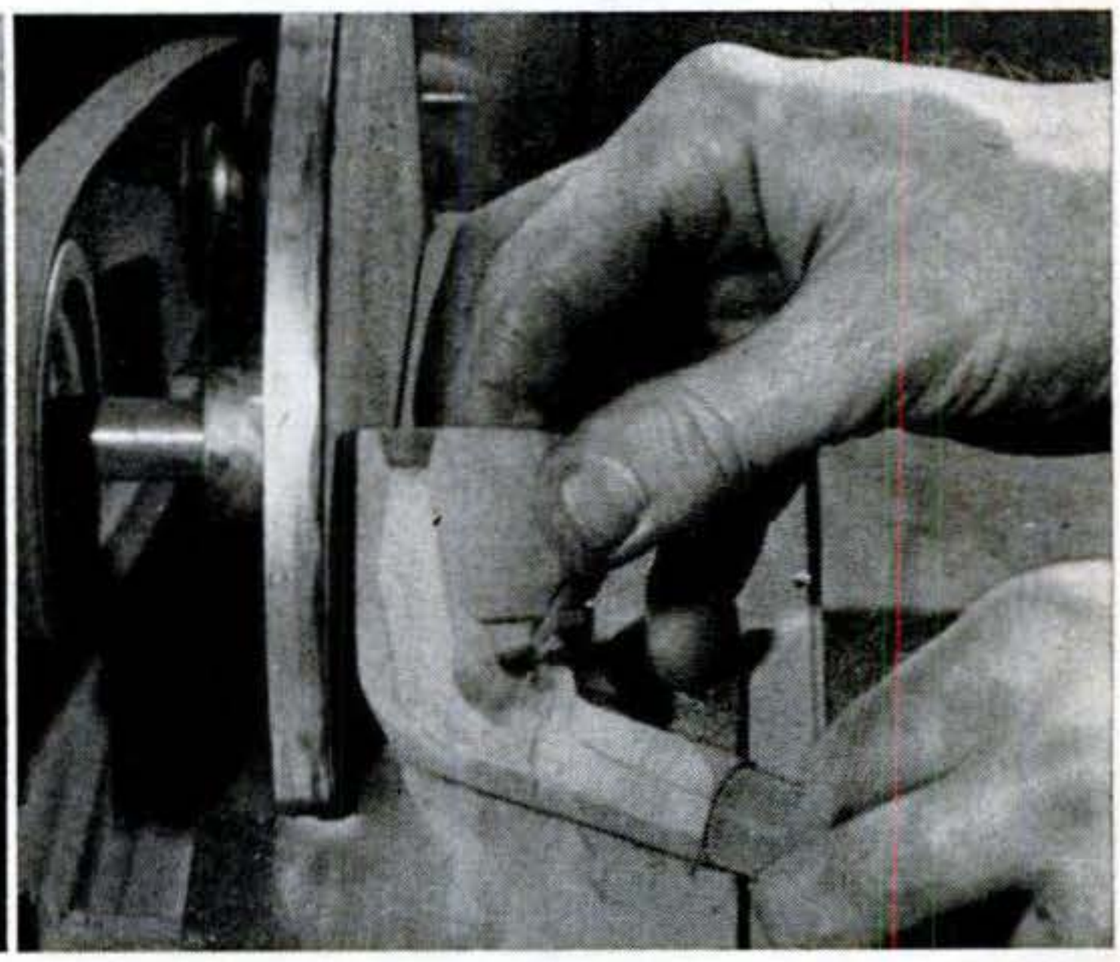
3 **LEAVING THE BLOCK** in the same position, change to a 1/8″ drill. Run in the smoke bore to the center of the tobacco hole, gauging drill depth by the side profile.



4 **RECLAMP THE BLOCK** with the top of the bowl horizontal. Use a round-bottomed drill if possible—otherwise an ordinary one—to open out the bowl to the smoke bore.

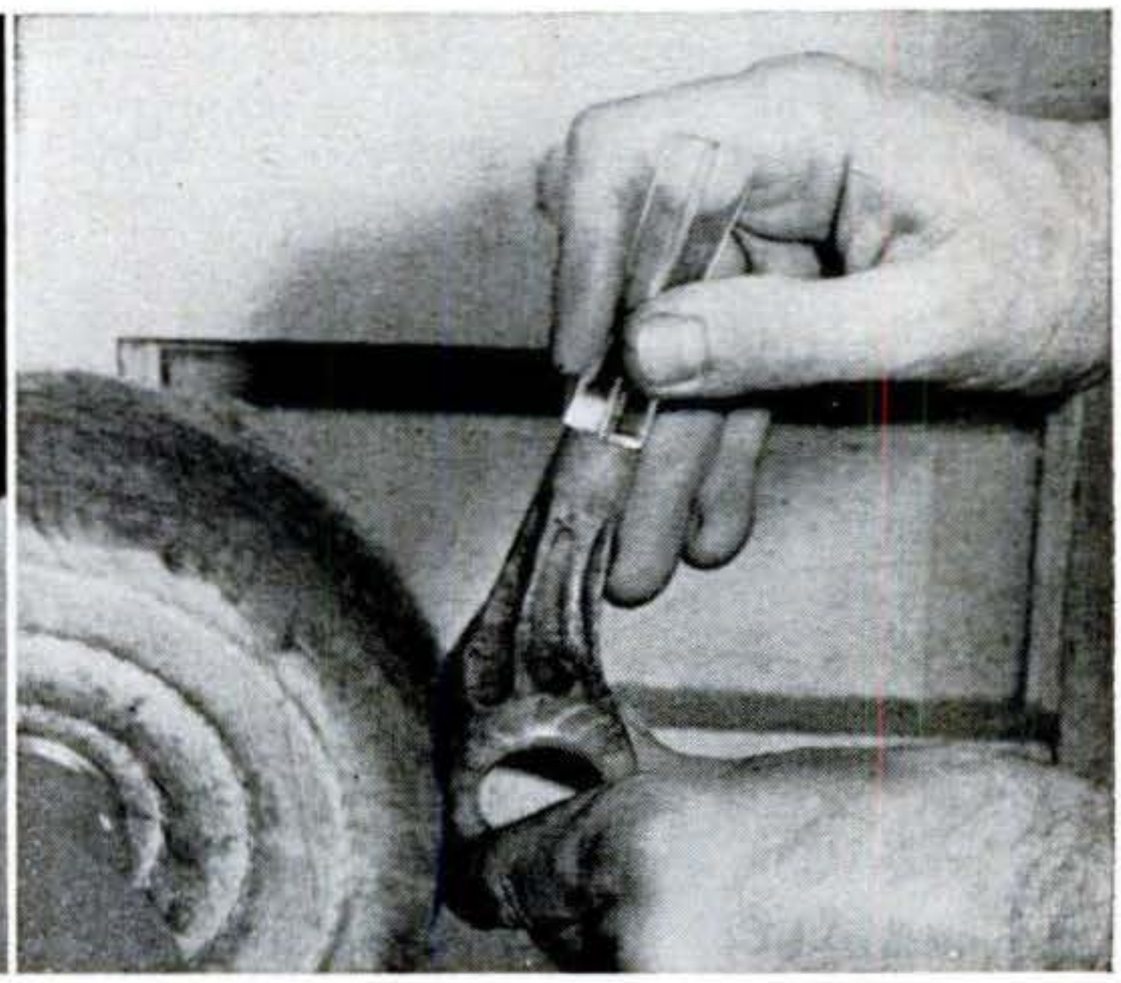


7 **YOU CAN GRIND** or turn a plastic stem to shape as in the drawing (or see PS, Feb. '49, p. 218). With the finished stem in place, rough-saw brier to scribed outline all around.



8 **LEAVE THE STEM IN** while you continue shaping the rough-sawed block. A power sander makes quick work of this, but rasps, files, or carving tools can be used.

11 **CARVE IRREGULAR GROOVES** down the bowl for the effect shown in step 12. Use a small gouge or rotary burr. Hand-sand to soften edges and remove tool marks.



12 **BUFF THE PIPE** on a cloth wheel with tripoli. This makes stem transparent and brings out brier's grain and luster. Wax the outside, and you're ready for a smoke. END

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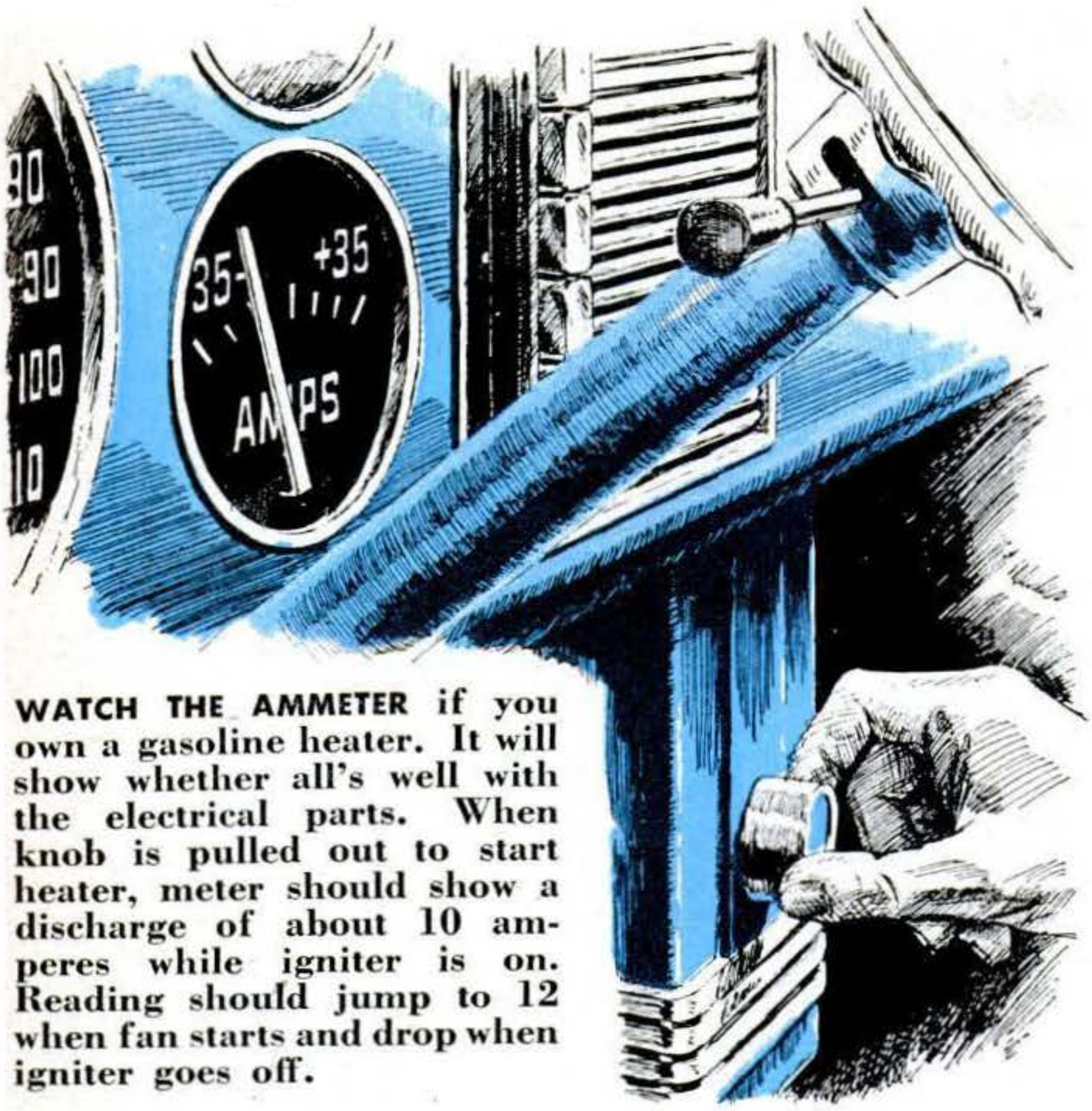
Hot Tips on Car Heaters

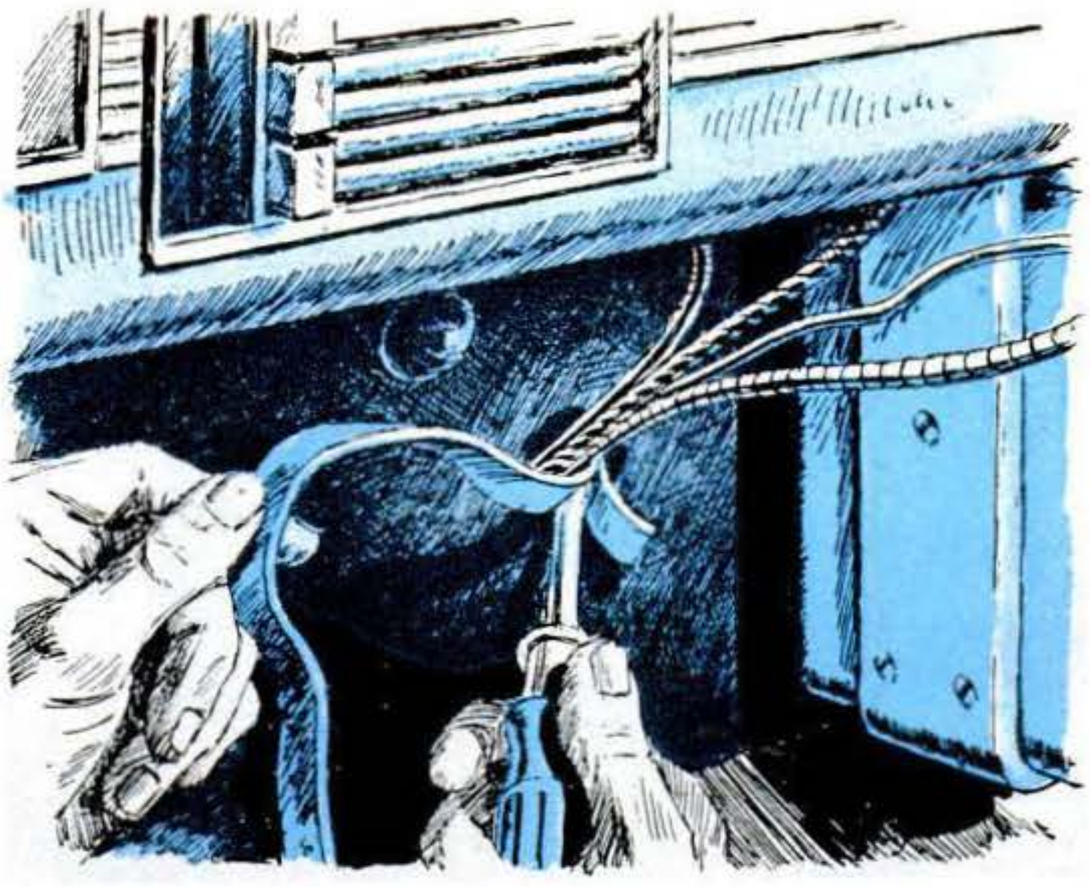


WATCH THE AMMETER if you own a gasoline heater. It will show whether all's well with the electrical parts. When knob is pulled out to start heater, meter should show a discharge of about 10 amperes while igniter is on. Reading should jump to 12 when fan starts and drop when igniter goes off.

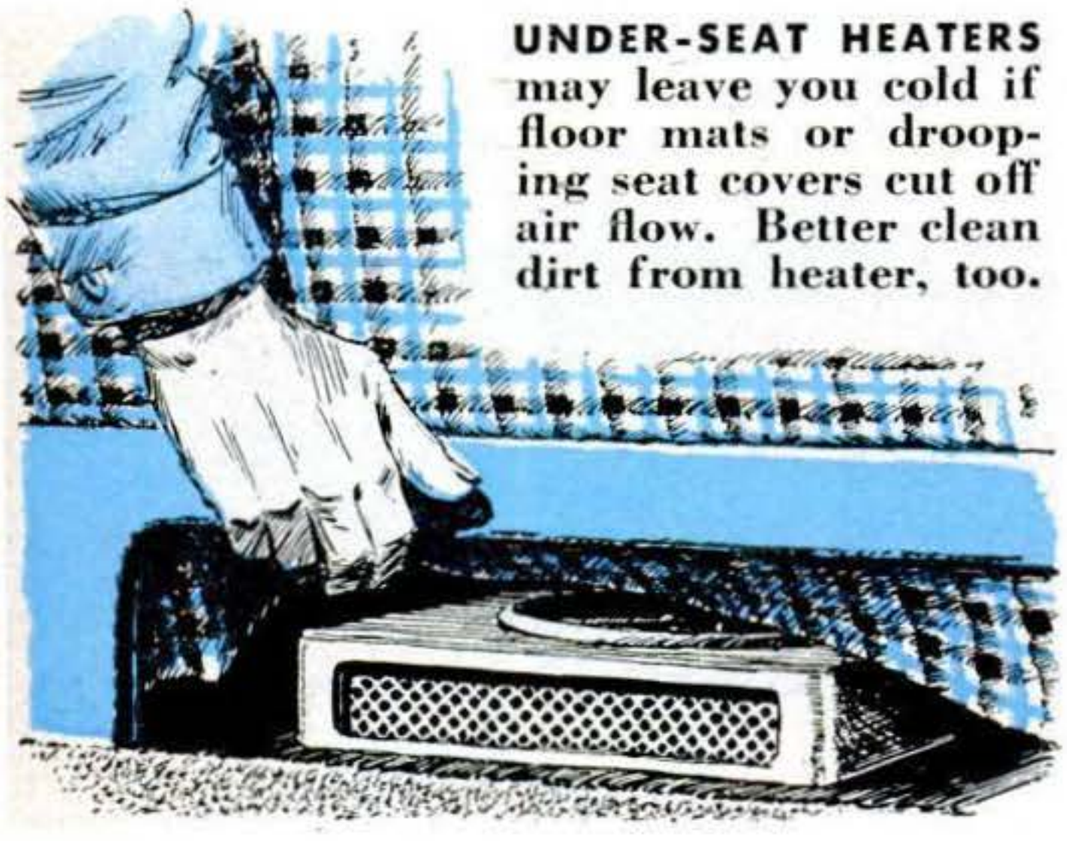
RUST AND DIRT may eventually cut efficiency of the heater core. Disconnecting the heater hoses and flushing with a garden hose, first one way then the other, may help. Apply a vacuum-cleaner hose to outside of core to suck out dust.

HEATER-BLOWER MOTORS sometimes lose pep because of bad commutators. The remedy—dress down or replace. Frayed insulation on wires leading to blower may short or open circuit. Replace such wires.

A HIGH-OPENING THERMOSTAT in the cooling system makes a hot-water heater more efficient by letting the water get hotter. But use only a permanent-type antifreeze with such thermostats. The high opening (around 170°F.) would boil away alcohol type.



TOO MUCH HEAT, leaking through firewall openings from the engine may keep you cold. This paradox happens if a thermostatically controlled valve regulates water flow through heater to maintain an even temperature inside car. Engine heat hitting the thermostat keeps the valve closed and the heater inoperative. Sealing leaks is the answer.



UNDER-SEAT HEATERS may leave you cold if floor mats or drooping seat covers cut off air flow. Better clean dirt from heater, too.

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How "Soupers" Pep Up Stock Engines

Brains in the fingertips help put more horses under the hood. Here are the facts behind the job.

By R. P. Stevenson

IN GARAGES, back yards, and alleys throughout the country, a mechanical revolution is under way. The rebels have one complaint in common. They're all dissatisfied with what they've got—a car with its original horsepower rating—and they're out to do something about it.

The idea of souping up a stock engine has always had devotees. But never so many as now. You see and hear their signs wherever you turn: the clank of wrench against metal, the sputtering take-off of an engine fitted with a racing cam, speed jockeys gathering for a meet, announcements of new clubs being formed. And since the war, there has been a mushroom growth of shops supplying such souping needs as high-compression heads, dual manifolds, and power cams—proof that there are thousands of persons who want more horses than they've got.

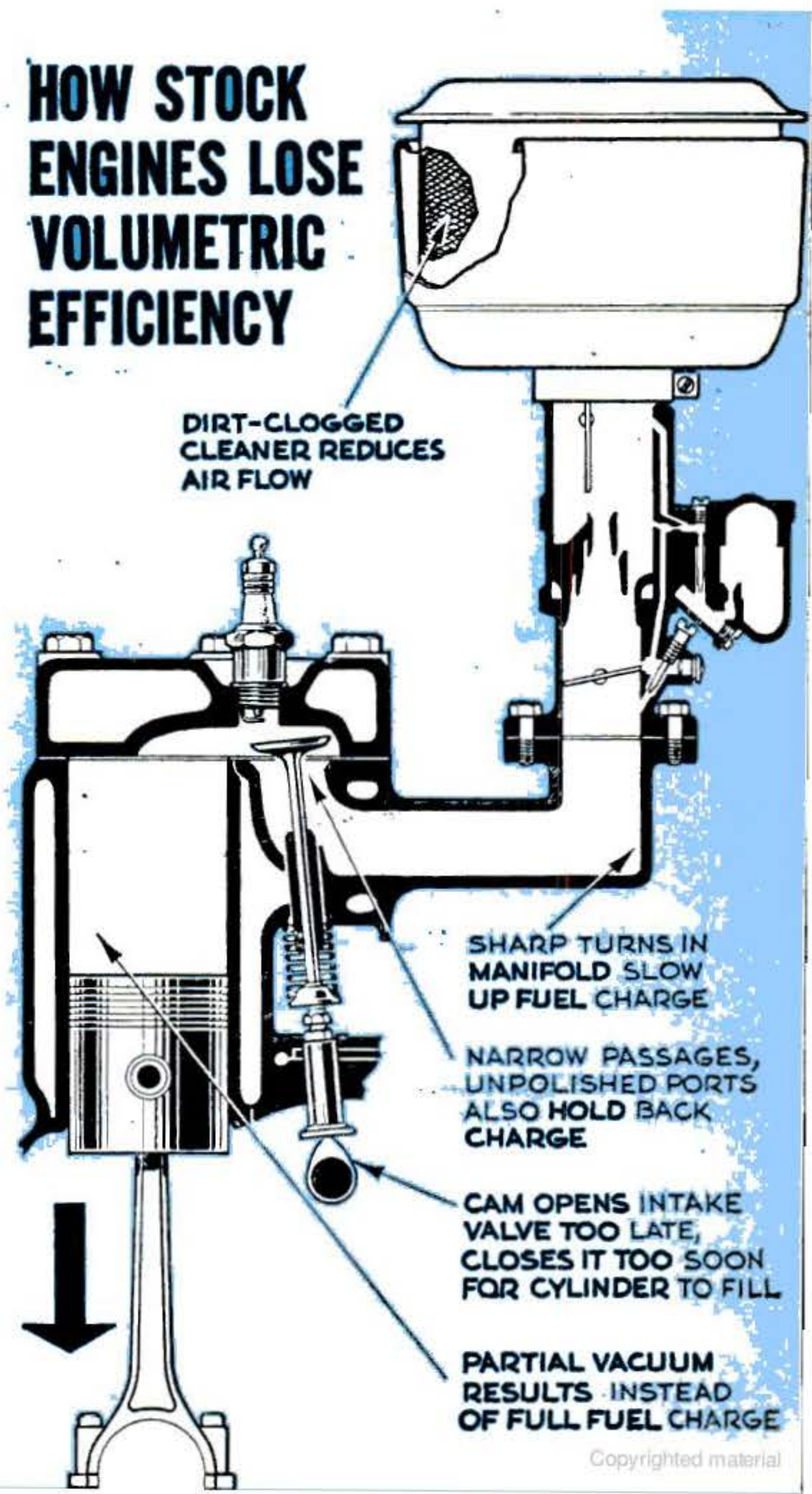
If you do, too, or if you already have been working over an engine, remember this point: Hit-or-miss methods *may* lead to greater power, but usually just by accident.

Generally the men who go farthest up the horsepower ladder are those who know *why* they're doing what they do—as well as how to do it. They can, for instance, answer questions like these:

- Why does a dual intake manifold help boost power?
- How is torque related to horsepower—and what *is* torque anyway?
- What is an engineer talking about when he speaks of "volumetric efficiency?"
- What is stroking, porting, relieving? Why can you expect them to add a few more horses to the engine?
- Why are camshafts reground?

In souping up an engine, brains in the fingertips always pay off. A knowledge of the theory and science behind all the approved souping steps will help you combine them to get the one big thing you're after—more and more power.

Volumetric efficiency. Improving en-



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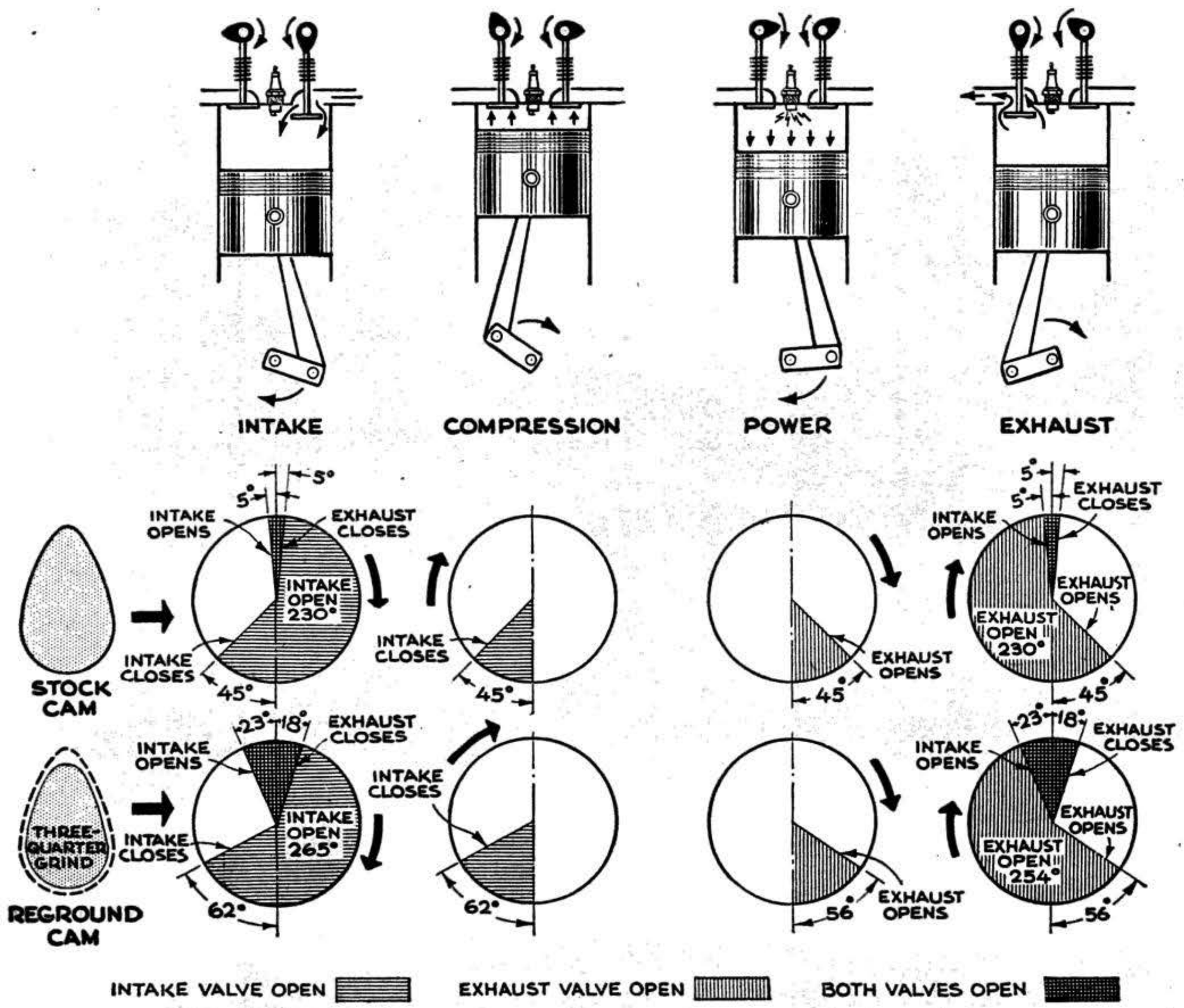

WHY CAMS ARE REGROUND. Study this diagram and you will see that a reground cam keeps both intake and exhaust valves open for longer periods. This helps increase the fuel charge on intake stroke, improves scavenging on exhaust. Longer valve stems are required to compensate for material ground off lobes. Sketch above gives approximate valve timing for a three-quarter cam. Others may increase open periods even more, as well as the intake-exhaust overlap. Double overhead cams like those shown are used in racing engines.

gine VE is the major objective of more soup-up procedures and accessories than you might think—porting, relieving, dual carburetors and intake manifolds, superchargers and reground camshafts. All help pack in more fuel. And that gives more power.

Engine breathing is the shop term commonly associated with volumetric efficiency, although the former covers less ground than the latter. VE refers to the quantity (or weight) of fuel mixture drawn into a cylinder on the intake stroke. It's best to think of the charge in terms of its weight rather than volume, for volume varies considerably with temperature changes. An engine's volumetric efficiency is expressed as a percentage of the theoretical quantity that should be drawn in if all conditions were ideal. They never are.

Factors that reduce VE. When you try to improve the efficiency of an engine, you have to buck several of the natural laws that you learned about in high-school physics. Here are the chief ones:

1. Friction. Air and vaporized fuel moving over surfaces of the carburetor, intake manifold, intake ports and around the intake valve are slowed up by friction in exactly the same way as a shaft revolving in a bearing. Porting, relieving and installing a special intake manifold all help reduce this frictional loss.

Porting consists of enlarging and smoothing out the gas-flow path between the manifold and valve seats. Just polishing the passages alone makes a whale of a difference in overcoming friction. In relieving, you remove metal from the top of the block to increase the gas-flow area between the valve seats and the cylinder bores. Intake manifolds for racing engines have large, smooth passages with few turns.

2. Inertia. It takes time and energy to start a charge of gas on its way from the

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carburetor for the same reason it takes you time to get up speed from a standing start. The piston descends so fast on the intake stroke that the incoming fuel charge can't keep up with it. A partial vacuum results in the cylinder. This vacuum increases steadily with engine r.p.m. Grinding the camshaft lobes so that the intake valves close later gives the fuel charge more time to get into the cylinders.

3. *Atmospheric pressure.* Because air pressure is highest at sea level, or below, you'll find that it forces more fuel into a cylinder in Death Valley than on Pikes Peak. Superchargers give VE a boost by increasing the pressure at the intake manifold. A dual manifold with two carburetors (one for each bank of cylinders on a V-8) also gives atmospheric pressure a better chance to shoot fuel into the cylinders. In addition, it helps cut down losses from friction.

4. *Gas expansion.* The hot cylinder walls cause the fuel mixture to expand. This means you can pack in less. The cooling system must be right up to snuff if you're to get extra horses out of an engine. Engines that preheat the fuel mixture to aid vaporization reduce VE.

Types of cam grinds. Installing a reground cam always boosts horsepower.

Theoretically, intake valves should open at top dead center, close at bottom dead center; and the exhaust should open and close in the reverse order. However, an intake valve must always be kept open beyond BDC, that is, during the first part of the compression stroke, to give the cylinder a chance to fill. The intake valve must also be timed to open several degrees before TDC, that is, in the last part of the exhaust stroke, for the simple reason that opening or closing a valve requires a measurable period of time.

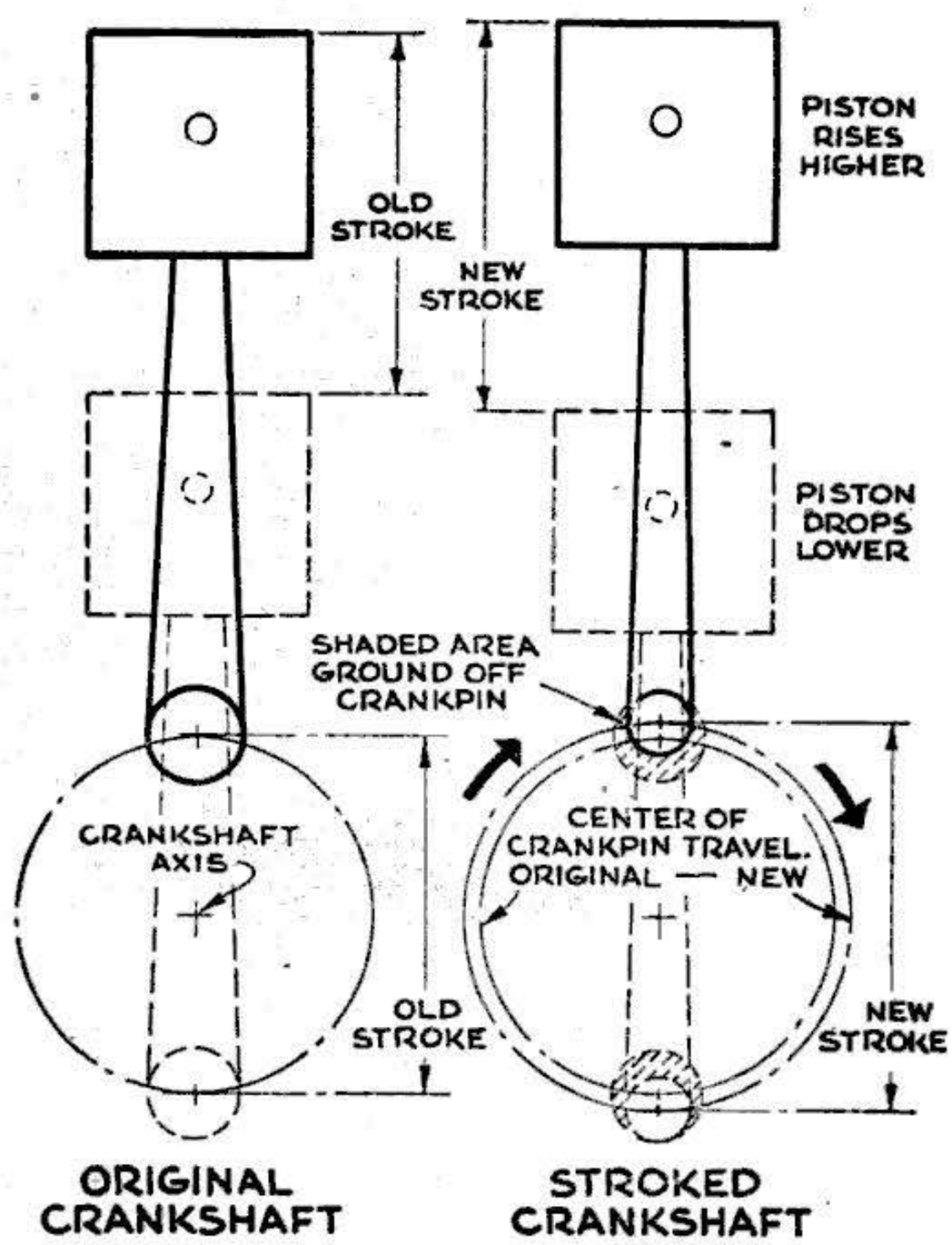
The object is to have the valve fully open when the piston starts down on the intake stroke. Likewise, exhaust valves open before BDC and close after TDC. They must open well before BDC so that the power-stroke pressure won't hold back the piston during the first part of the exhaust stroke.

In general, the various cam grinds—semi, three-quarter, full, super-full and special—progressively move both intake- and exhaust-valve timing away from dead center. Following the same pattern, the engine must turn over at a higher and higher r.p.m. to run smoothly. At low r.p.m., it bucks, kicks and backfires. For one reason, cylinder vacuum is so low at low r.p.m. that late closing of the intake valve allows some of the charge to be pumped back out by the compression stroke. That's why stock cams must represent a compromise between smooth idling and a reasonable amount of power at higher r.p.m.

Increasing piston displacement. While improving VE is one way of packing in more fuel, it's not the only one. Enlarging the engine capacity is another way of doing it.

This is done by boring out the cylinders to a larger diameter and installing larger pistons and by stroking the crankshaft, that is, grinding the crankpins to new centers so that the pistons rise and fall a greater distance within the cylinders. An accompanying sketch shows how this works. Special pistons must then be used. Their pins are located nearer the top so the piston head won't ram the cylinder head, and their skirts are shorter to keep the pistons out of the crankcase.

A high-compression cylinder head, one of the most popular souping steps, improves fuel economy somewhat, besides helping to deliver more torque at the flywheel. This is an easy path to more power,



STROKING CRANKSHAFT is done by grinding down crankpins so new centers are farther from the crankshaft axis. This gives piston a longer travel, increases engine displacement.

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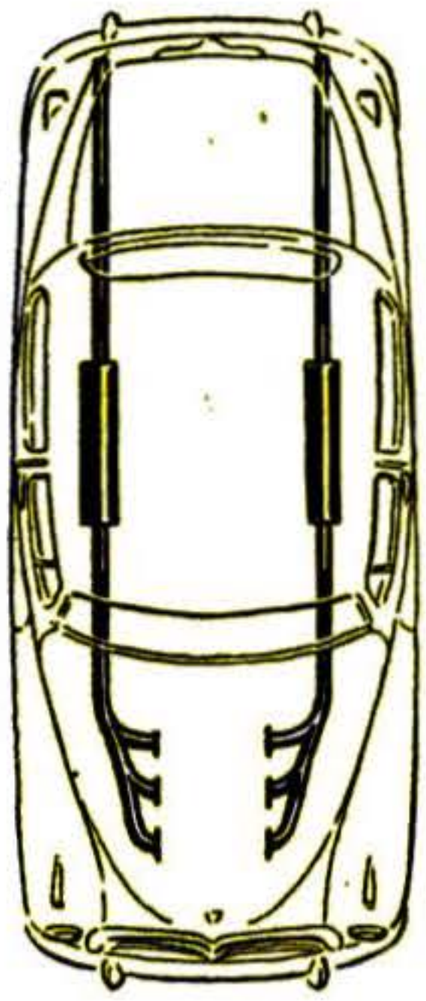

WHY DUAL EXHAUSTS? Two tailpipes are not just for looks. On a V-8, a separate exhaust system for each cylinder bank may add as much as 10 percent to the original horsepower. In a souped-up engine, exhaust gases can't escape fast enough through stock pipes and muffler. Consequently they tend to beat back into the cylinders, upsetting the volumetric efficiency. Straight-through mufflers are also used to reduce this back pressure.

but current roadside fuels impose a top limit of about 8.5-to-1 compression. Incidentally, the mechanic who relieves a block should bear in mind that removing metal decreases the compression ratio by making the combustion chamber larger.

More torque is the big objective in souping up an engine. Raise the peak torque and you automatically boost the peak horsepower.

Torque results from force applied around a center of rotation. When you turn the steering wheel of a car, you apply torque to the steering column. In the same way, the engine's explosive force exerted on the pistons becomes torque at the flywheel.

Torque is the product of two factors—the force you apply and the radius of the circle you apply it in. Put 10 pounds of force on a crank one foot long (radius) and you get a torque of 10 pound-feet. Lengthen the crank, say to two feet, and torque becomes 20 pound-feet.

But torque alone doesn't give horsepower, which is what you're after. Engine r.p.m.—how fast torque turns the flywheel—is involved, too. Power, you remember from high-school physics, is the rate of doing work, and work is force multiplied by the distance through which it is applied. So by properly combining torque and r.p.m., you get time, distance and force—the three elements that make up power. Increase torque at any r.p.m. and horsepower goes up. Likewise, increase r.p.m. (keeping torque constant) and horsepower goes up.

If you examine a chart showing the torque and horsepower curves for a stock engine, you'll find that the torque curve hits a peak at perhaps 1,800 r.p.m.—and then slides steadily downward—while the horsepower continues to climb steadily to about 3,600 r.p.m. before falling off.

Why torque falls off. There are two major reasons, both of them resulting, oddly enough, from the greater engine speed. One is reduced volumetric efficiency. (The pistons are working so fast that a full fuel charge can't be drawn in.) The other is the rising friction that always accompanies running a mechanism at higher and higher speeds.

Despite the falling torque, horsepower continues to rise because another of its major constituents—r.p.m.—continues to increase. Horsepower goes on climbing as long as the percentage of r.p.m. gain exceeds the percentage of torque loss. When gain and loss equalize, the horsepower peaks, too. Any further boost in r.p.m. would only bring a horsepower drop.

From this you can see that any souping procedures that raise the torque peak will also send up the peak horsepower. In stock engines, torque usually peaks at about one-half the r.p.m. where horsepower levels off. In a "hot" engine, the one-half relationship no longer holds. The more souping you do, the closer the peak torque moves to peak horsepower. In full racing engines, the peak torque stands about two-thirds of the way up the r.p.m. ladder. END

NEXT MONTH, read how an expert would soup up a stock engine. The author, Jim Pauley, a noted racing driver, cut his mechanic's teeth on Model A hop-ups and sharpened them on midget racing cars, winning championships in 1946 and 1947.

About the same time, he set himself up in the business he still runs at Banksville, N. Y.—a sports-car repair and service center that goes under the name of Sports Car Enterprises. Foreign sports cars are now Jim's specialty, but he frequently gets his wrenches into American cars, too. Few sports-car contests on the East Coast are complete these days without Pauley as a driver, and he consistently comes in a winner.

Don't miss his authoritative souping article next month.

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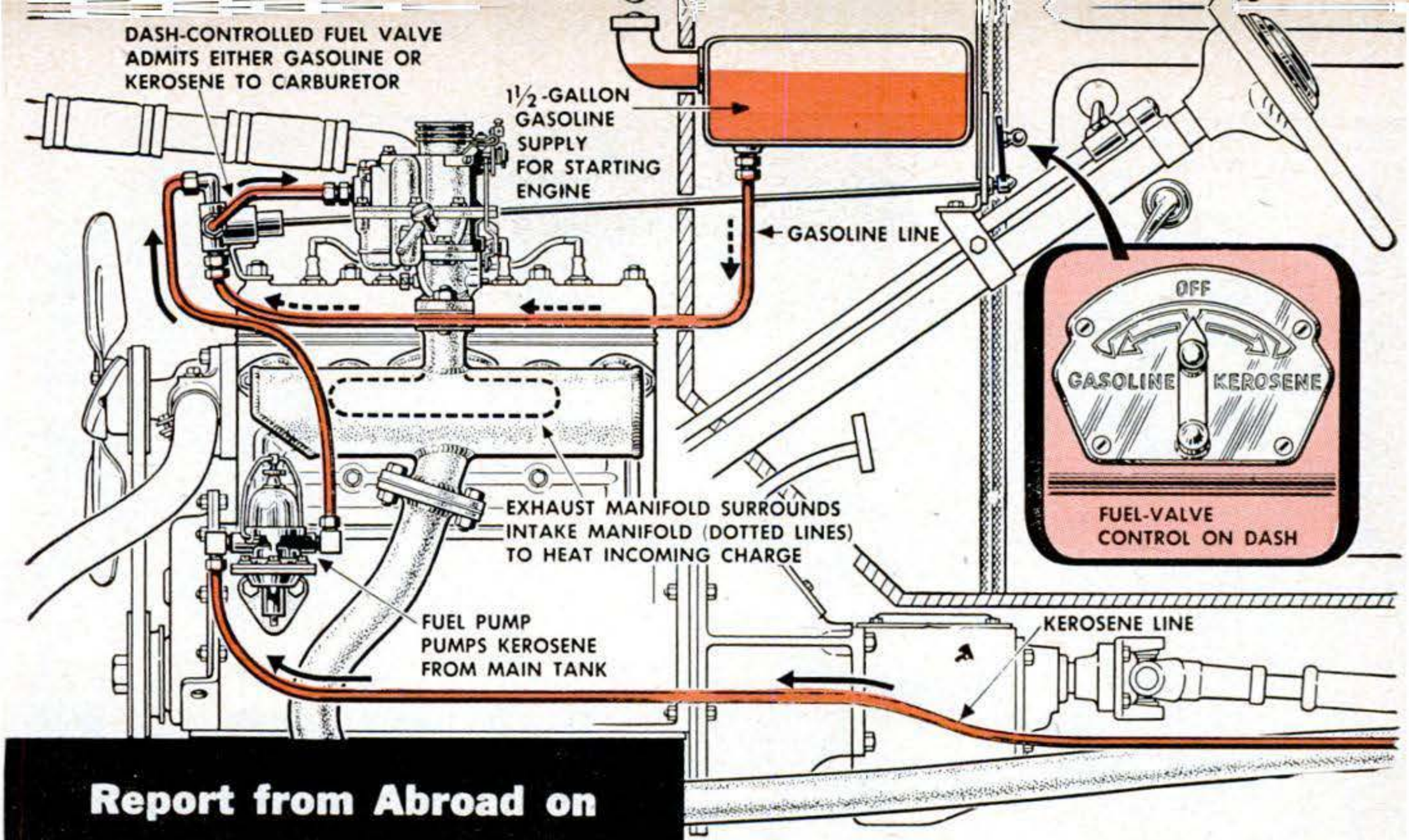

Report from Abroad on Kerosene-Fed Cars

Kerosene-burning jeep. In this sketch, artist Stewart Rouse indicates how kerosene unit made in Europe can be fitted to a jeep engine.

VIENNA, AUSTRIA

Dear Editor:

American motorists who like to save gasoline should see how it's saved in Austria. Over here, gasoline is rationed and very little is available. To keep going, many cars are equipped to burn kerosene as their main fuel.

A kerosene burner called the Econom leads the field. Around Vienna, you find it on quite a few American cars as well as the European makes. It has five major parts—a combined intake-exhaust manifold, a 1½-gallon gasoline tank, a dual fuel line, a dashboard-mounted valve for switching from one fuel to the other, and a compression-reducing spacer plate to go under the cylinder head.

Your older readers may recognize this assembly as similar to a kerosene-burning unit marketed in the U. S. during the Twenties. They will also remember that the first Fordson tractors burned kerosene. But gasoline was so cheap in the States 25 years ago that kerosene didn't get far.

Gasoline Used for Starting

Like the old American units, the Econom burner resorts to gasoline for starting the engine when cold. The gas feeds by gravity from a small tank under the hood. After the engine is warm, you switch the dashboard valve and the regular fuel pump delivers kerosene to the carburetor from the main tank. Smart drivers have learned to switch back to gas before shutting off the engine—that fills the carburetor with gas for starting.

For good combustion the kerosene-air mixture must be heated. That's the job of the combined manifold. An engine-length steel box surrounds the original intake manifold. Exhaust gases are collected in this outer manifold and carried to the exhaust system, heating the walls of the intake manifold as they pass.

Spacer Cuts Compression Ratio

A lower compression ratio is required. To reduce it to 4.5 or 5 to 1, an aluminum plate matching the gasket is installed between the block and cylinder head.

An engine gets 80° F. warmer with kerosene than with gas, but this heat increase improves combustion. However, the extra heat makes it necessary to use heavier motor oil and change it more frequently.

Operating on kerosene gives less power and pep. But people here who drive American-made cars don't mind since these cars have, by European standards, a huge power reserve. Since fuel costs are some 60 percent less, the power loss is not hard to take.

The Econom kit can be used on any four-cylinder, six-cylinder, or straight eight engine that has both intake and exhaust manifolds on the same side.

FREDERICK H. BAER

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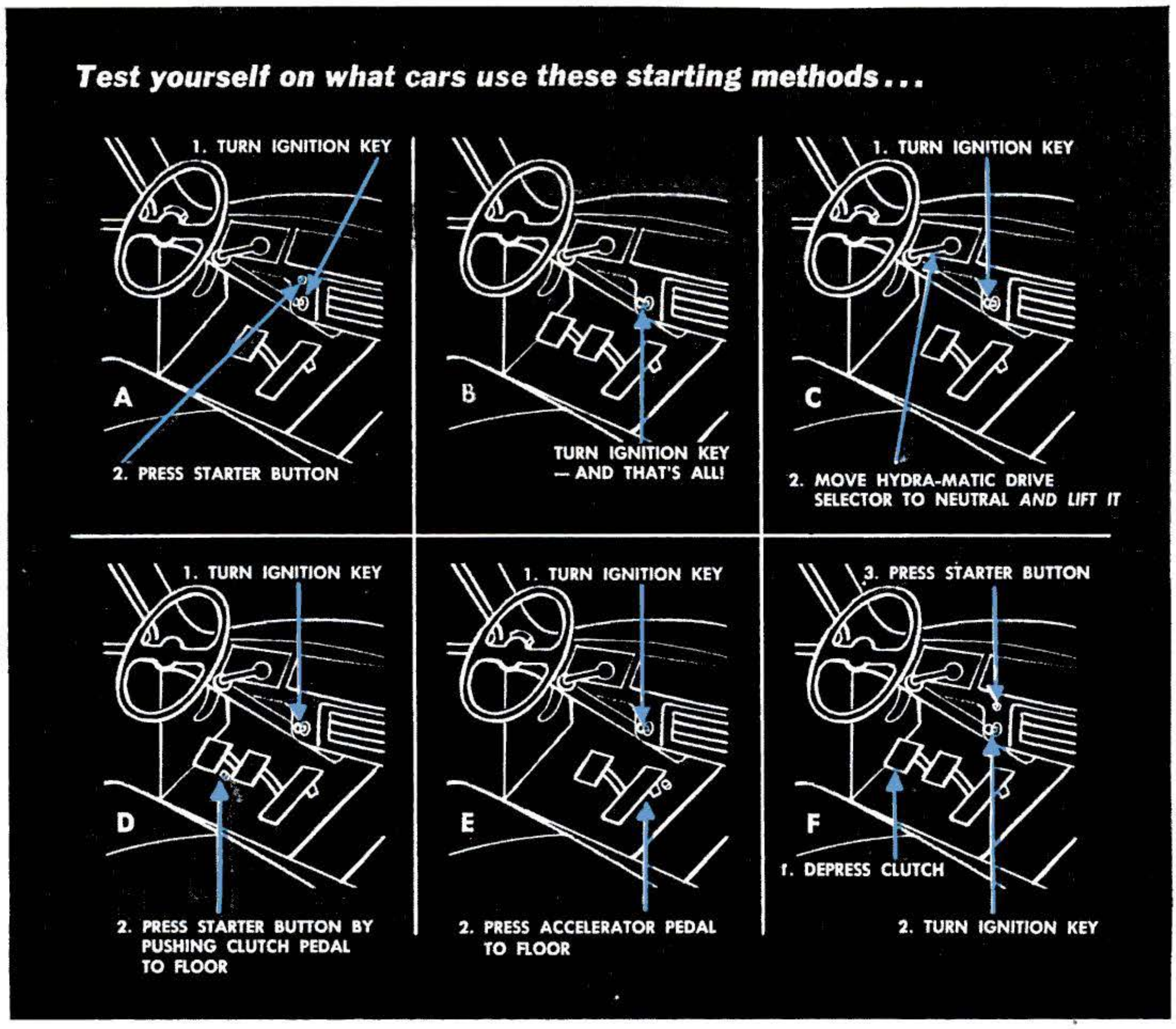

Can You Start a Friend's Car?

IT IS tougher than you may think to slide into the driver's seat of an unfamiliar 1951 car, and start the engine promptly. U. S. motor makers are using as many ways to fire up their engines as to shift their gears. One reason is the buying public's fondness for appealing gadgetry. Another reason is the ancient problem of the absent-minded driver who starts the engine while it is connected to the wheels—a slip that may be comic but is sometimes tragic in its consequences.

On two cars the starter button is under the clutch pedal: you push the clutch down to hit the starter. In another, the dash button won't work unless the clutch is down. Most automatic drives have interlocks that cut out the starter unless the selector is in Neutral or Park.

Test yourself by trying to match up the six different starting procedures for 1951 cars shown above with the twenty-five combinations of make and drive listed below. Steps such as using a hand choke or putting a hand shift in neutral are omitted for simplicity.

Answers

(A) Hudson (with standard and Hydra-Matic transmissions), Mercury, Lincoln, Chevrolet, Pontiac, Oldsmobile, Kaiser, Frazer, Henry J, Jeep and Crosley. A Studebaker with automatic transmission also fits in this category, although you pull a lever rather than push a button. (B) Cadillac, Plymouth, Dodge, DeSoto, Chrysler and Ford. (C) A Nash equipped with Hydra-Matic. (D) Nash and Studebaker with standard transmission. (E) Buick and Packard. (F) Hudson with Supermatic transmission. Starter won't work until clutch is down.

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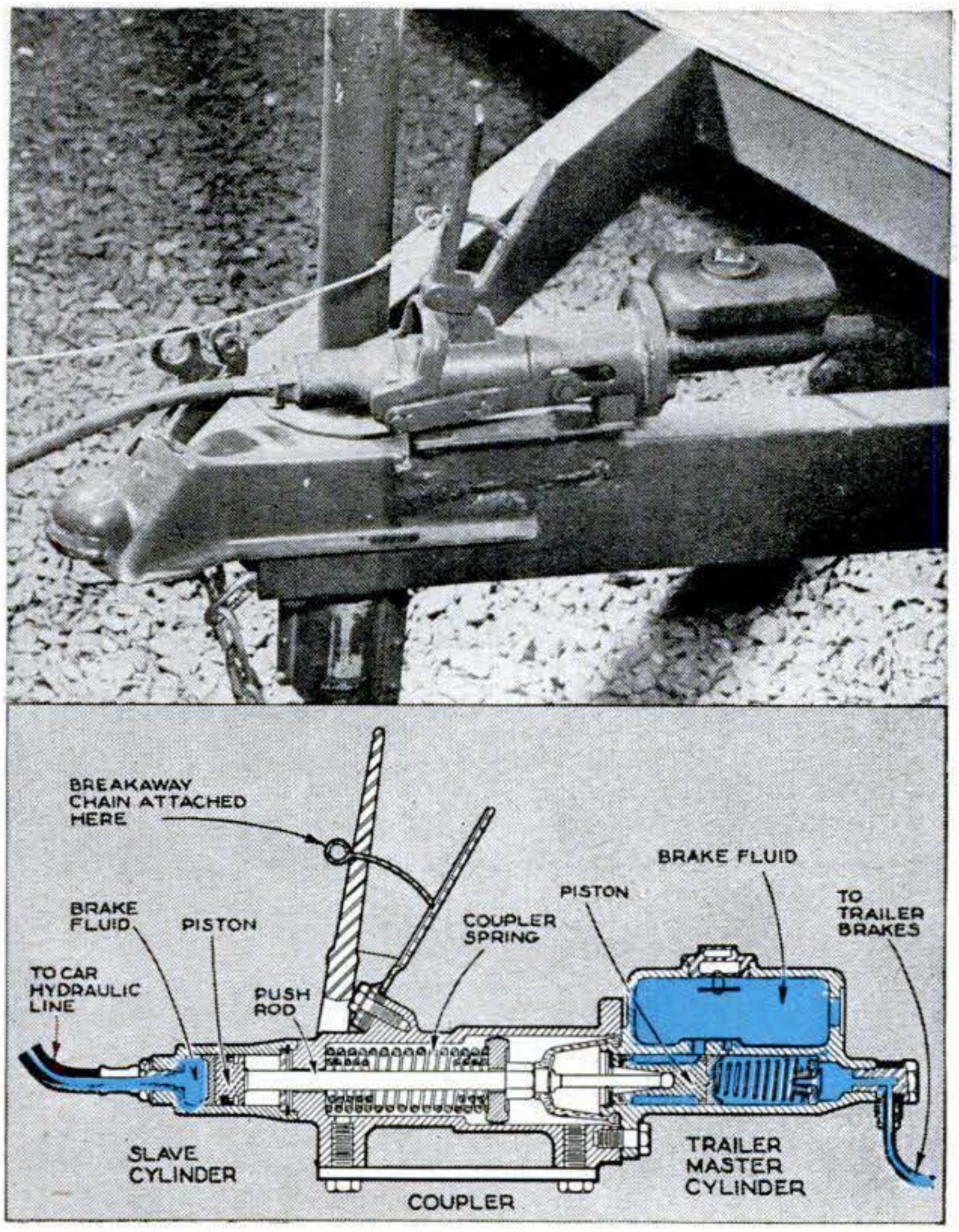


SLAVE CYLINDER, connected to car by hydraulic line, hooks to coupler mounted on trailer. When vehicles are hitched, linkage operated by upright lever compresses coupler spring. Pushing down car brake pedal causes slave-cylinder piston to move push rod that, in turn, moves master-cylinder piston on trailer. If trailer should become uncoupled, breakaway chain unhooks the upright lever, causing coupler spring to set trailer brakes. At same time, slave cylinder slips free, preventing fluid loss or damage to car brakes.

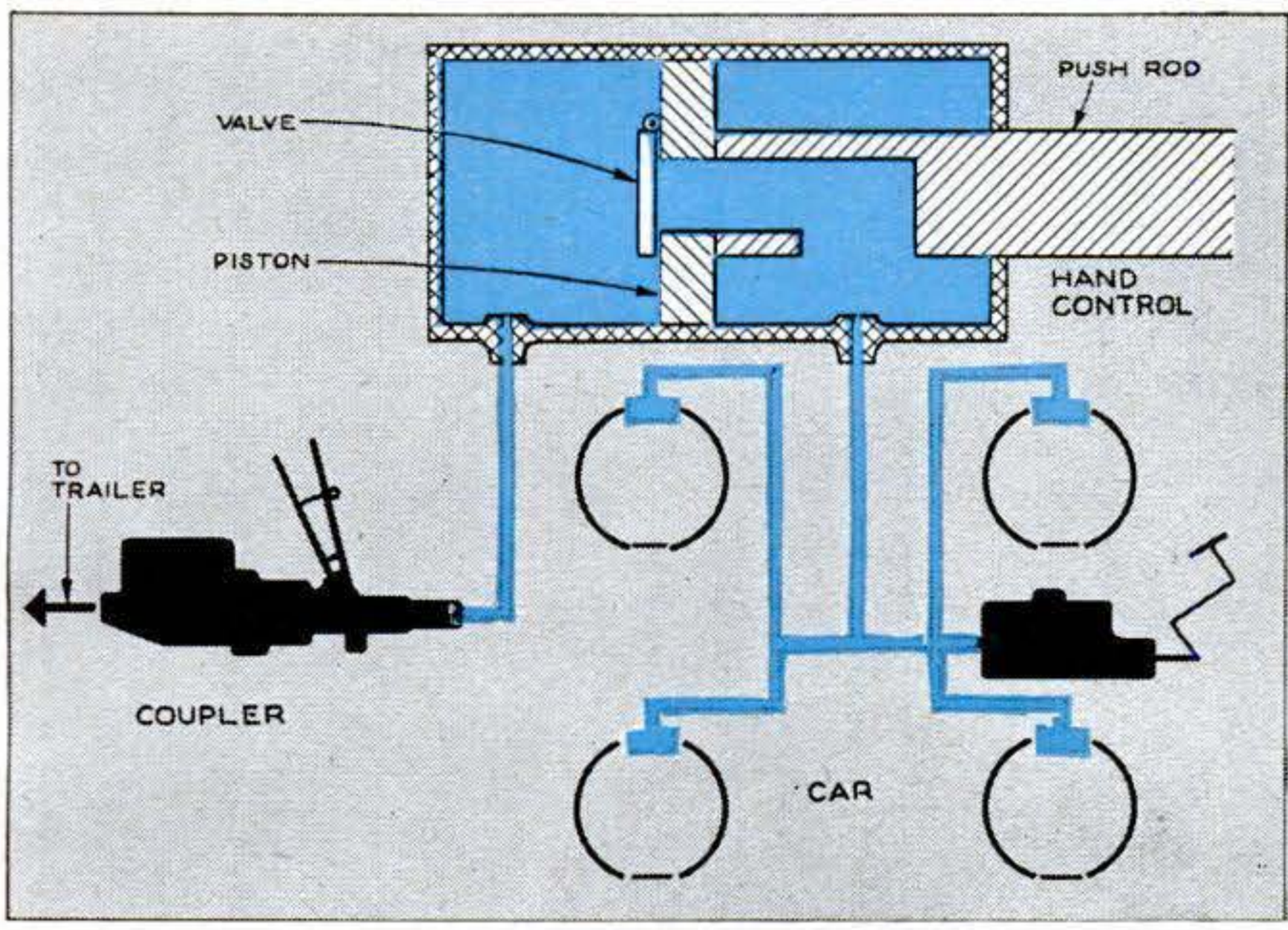
Trailer Brakes Go Hydraulic

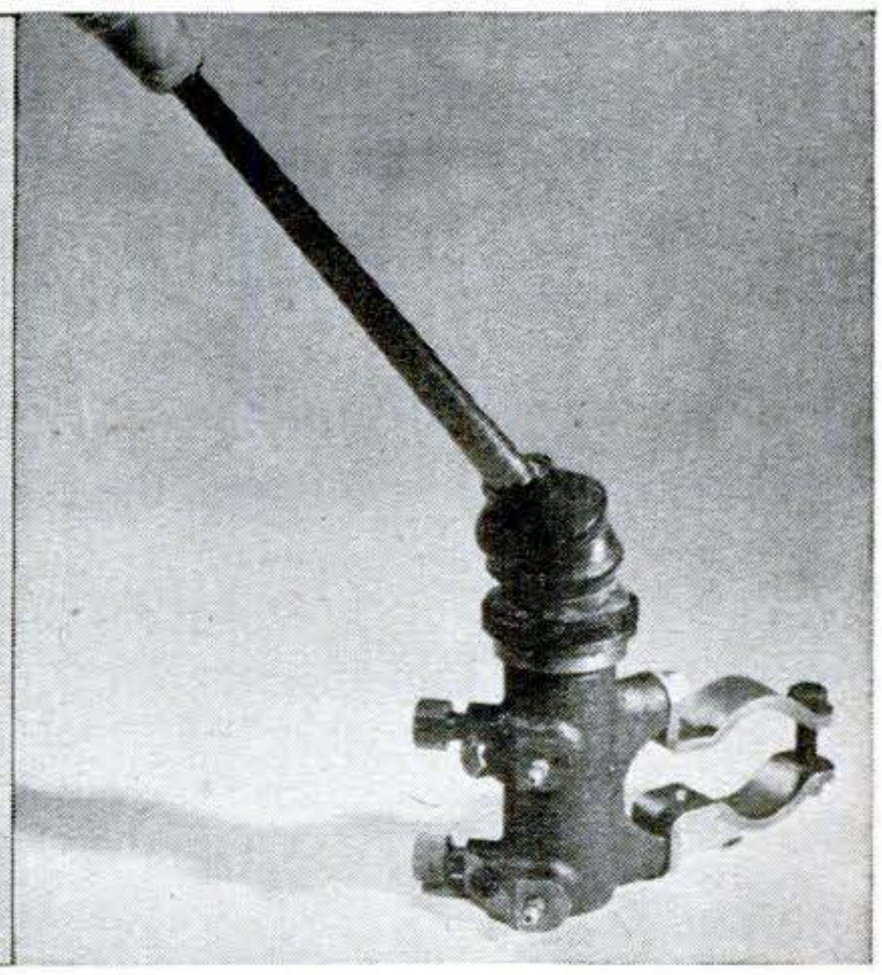
TOUCH the regular brake pedal, and this new coupling unit applies hydraulic brakes simultaneously to a car and the trailer coach it is towing.

The unit consists of two parts, one in the car's hydraulic system, the other in the trailer's. These hydraulic parts are linked mechanically so that the trailer can be hitched or unhitched quickly without loss of fluid.

Made by the Stromberg Hydraulic Brake and Coupling Co., Chicago, the hydraulic coupling unit is original equipment on some new trailers and is offered as an accessory for others. The trailer brakes themselves are the same type used on cars.

A hand control, mounted on the steering column of the car, gives separate trailer braking if desired.





HOW HAND CONTROL WORKS. This sketch shows the principle. If pedal is used alone, valve in hand control opens, allowing pressure to build on both car and trailer brakes. If hand control is used alone, valve closes and car brakes are not applied. If foot pedal is pressed while hand control is being used, pressure in car system gradually overbalances that exerted by control and valve opens, equalizing pressure on car and trailer brakes.

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The two men were standing in the road waving their arms and shouting at each other.

Gus Cracks the Ice for Santa

By Martin Bunn

Christmas looked tough for Tony—his trees late for market, a smashup and lawsuit on his hands. Just the spot for Santa's helper from the Model Garage.

A HEAVY blizzard just after Thanksgiving had snarled up traffic. Subsequent storms added to the snowfall—till now, only a couple of weeks before Christmas, high banks were piled up on either side of the roads.

As a result, most of Gus Wilson's chores at the Model Garage consisted of mending broken tire chains and sending out the wrecker to pull cars out of the drifts. And that sort of work isn't Gus Wilson's idea of the garage business.

It was about nine o'clock one night with the mercury dipping uncomfortably to the zero mark, when Gus and Stan Hicks, his helper, were driving back to the garage from one of the many tow calls. Gus wouldn't have answered the call at that hour if it hadn't come from his old crony Doc Marvin,

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who had got himself stuck in a drift on the outskirts of town and had to get back to the hospital to perform an operation.

"Cripes, it's cold," grumbled Stan as Gus maneuvered the wrecker along the white ribbon of road between the snowbanks. "A hot cup of coffee sure will taste good."

"Dan's Grill is the next stop," Gus assured him, "if I don't slide off the road into one of these drifts myself."

Just then a horn blasted and headlights flashed behind them. Gus swerved the wrecker as far to the right as he could, and a big sedan sped by. It kicked up such a swirling plume of snow that Gus had to slow almost to a stop.

A Guy Looking for an Accident

"Darned fool," muttered Gus as he switched on the wipers to clear the windshield. "There goes a guy who's sure looking for an accident."

Gus no sooner had the words out of his mouth than there was a muffled, crunching crash up ahead.

"Sounds like he's found it," said Stan.

Gus slowed the wrecker for the hill and curve that he knew were ahead. A glow from headlights told them that the crash was probably just around the turn.

It was an odd sight. The big car that had passed them had plowed into the rear of an open truck piled high with Christmas trees. Through a cloud of churned-up snow and falling balsam needles, Gus and Stan could make out the figures of two men standing in the middle of the road. One was a big heavy-set fellow, the other small and slight. The little man was waving his arms wildly. Both were shouting at the tops of their lungs.

Gus Cools Off a Hothead

"Anybody hurt?" called Gus as he and Stan slid out of the wrecker's cab.

The shorter of the two men ran toward Gus, and Gus recognized Tony Johns, a successful truck farmer with a place a few miles out of town.

"Gus," said Tony, "am I glad to see you! I parked here just a few minutes ago to see what was wrong with my truck and the next thing—whammo—this guy smashes into the back of my truck. Now he says he's gonna sue me!"

"You're blamed right I am," shouted the big man, pulling the collar of his heavy overcoat up around his ears. "You picked a fine place to park on a night like this."

"The truck was acting up so I had to stop. I pulled over to the side of the road as

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far as I could without getting into a drift."

"Well, there's a law in this state that says when a truck is parked for repairs, the driver must set out flares to warn other drivers."

Gus hadn't the slightest idea who the man was. Judging from his car and clothes, he was someone with money and maybe influence—but Gus felt it was about time he stepped in.

"Now wait a minute, mister," he said. "When it comes to laws, there's also a law against reckless driving, and I wouldn't call what you did when you highballed past me back there exactly safe driving."

"Well, what about my car?" asked the man, cooling off considerably.

No Great Harm Done

Gus walked over to the big sedan. Judging from the tracks in the snow the car had been braked considerably before plowing into the back end of Tony's truck. The skid had turned the big sedan slightly sideways and a few extra Christmas trees that Tony had tied onto the back of his truck evidently had helped ease the shock. The angle at which the car hit had saved the radiator. About all the damage Gus could detect was a slightly rumpled right fender.

"Have you tried to start her?" Gus asked.

"No."

"Well, see if you can, then back her away slowly."

The big man grunted as he squeezed himself under the wheel. The engine took hold immediately.

"Okay," called Gus. "Now ease her back."

Inch by inch the front of the car moved away from the truck and its load of trees. As it did, Gus followed, looking down at the right wheel and fender.

"No great damage, mister. Set your brake for a minute and I'll bend this fender up a bit so there'll be no chance of the wheel hitting it when you make a sharp turn. Then you can be on your way. There, that's got it."

Stranger Drives Off in a Huff

Without so much as a "thank you" the big man shifted into first and turned out into the road. He leaned out of the driver's window and shouted, "You farmers haven't heard the last of me yet." And then he roared off down the highway.

Gus laughed. "Pleasant sort of guy to run into on a dark night. Now tell me, Tony, what are you doing out on a night like this?"

"Christmas trees," replied Tony, waving his arm in the direction of his truck. "Got a new winter business. I buy 'em, cut 'em down and sell 'em in the city. This is my first load and I gotta deliver these trees tonight. But something's gone wrong with my truck."

"Engine stalled?"

"No, but right after I left my farm she began to shake. You know," Tony added, groping for the right word, "she began to . . ."

"Vibrate?"

"That's right, she vibrated from side to side. And the faster I went the worse she shook. So finally I stopped here to take a look."

"Umm. Well, there's no sense trying to find what's wrong out here. Let's head for the garage. I'll drive the truck and Stan can trail us in the wrecker just in case things get worse."

Gus Gets the Shakes

They hadn't gone very far when Gus realized that the vibration Tony had complained of was no figment of the imagination. At slow speeds, it wasn't too noticeable, but when the truck hit about 25 she really started to shake.

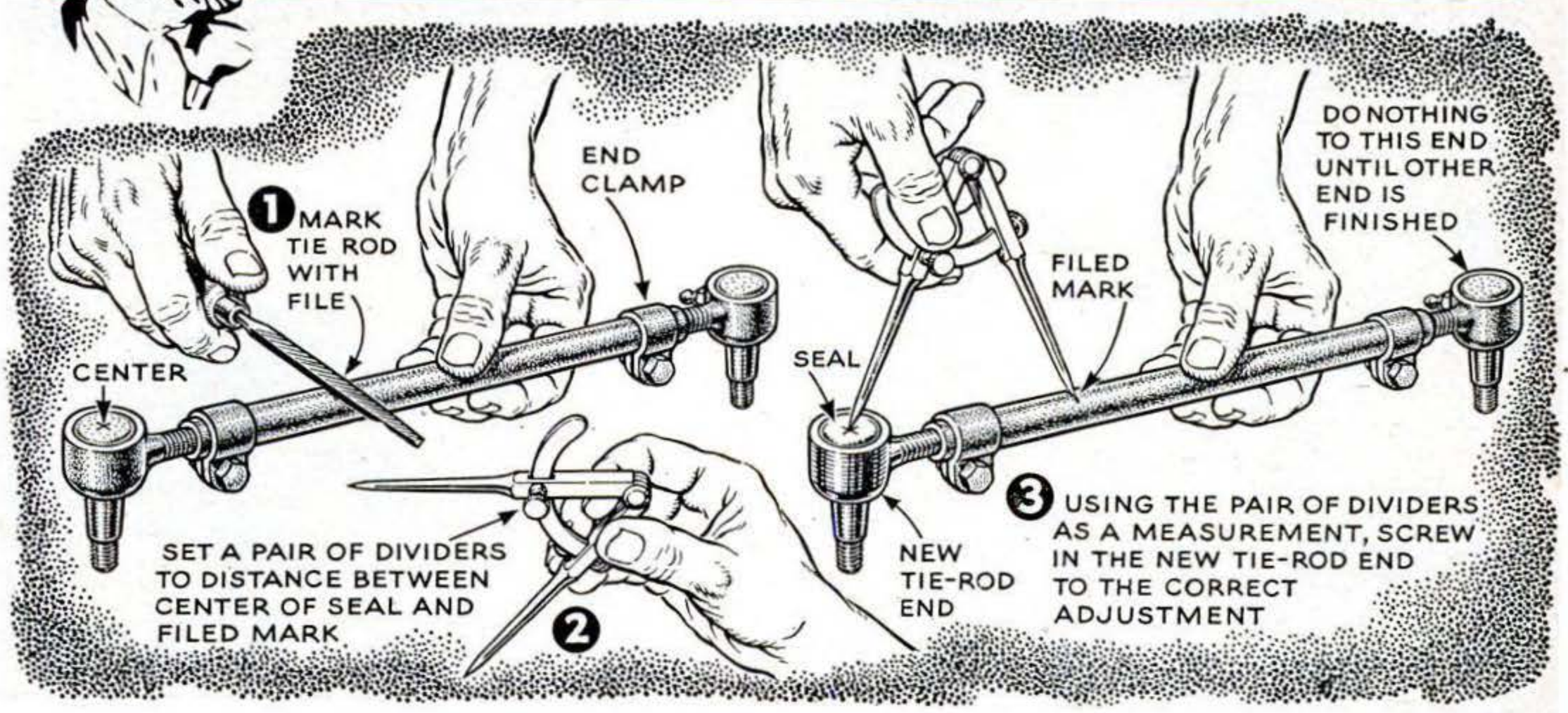
"When did you first notice this?" asked Gus, his voice quivering in tune with the vibration of the truck.

"Right after I started out tonight. She always ran fine up to now."

When they reached the Model Garage Stan, who had gone on ahead in the wrecker when he saw that the truck would make it, had the doors open and the lights on.

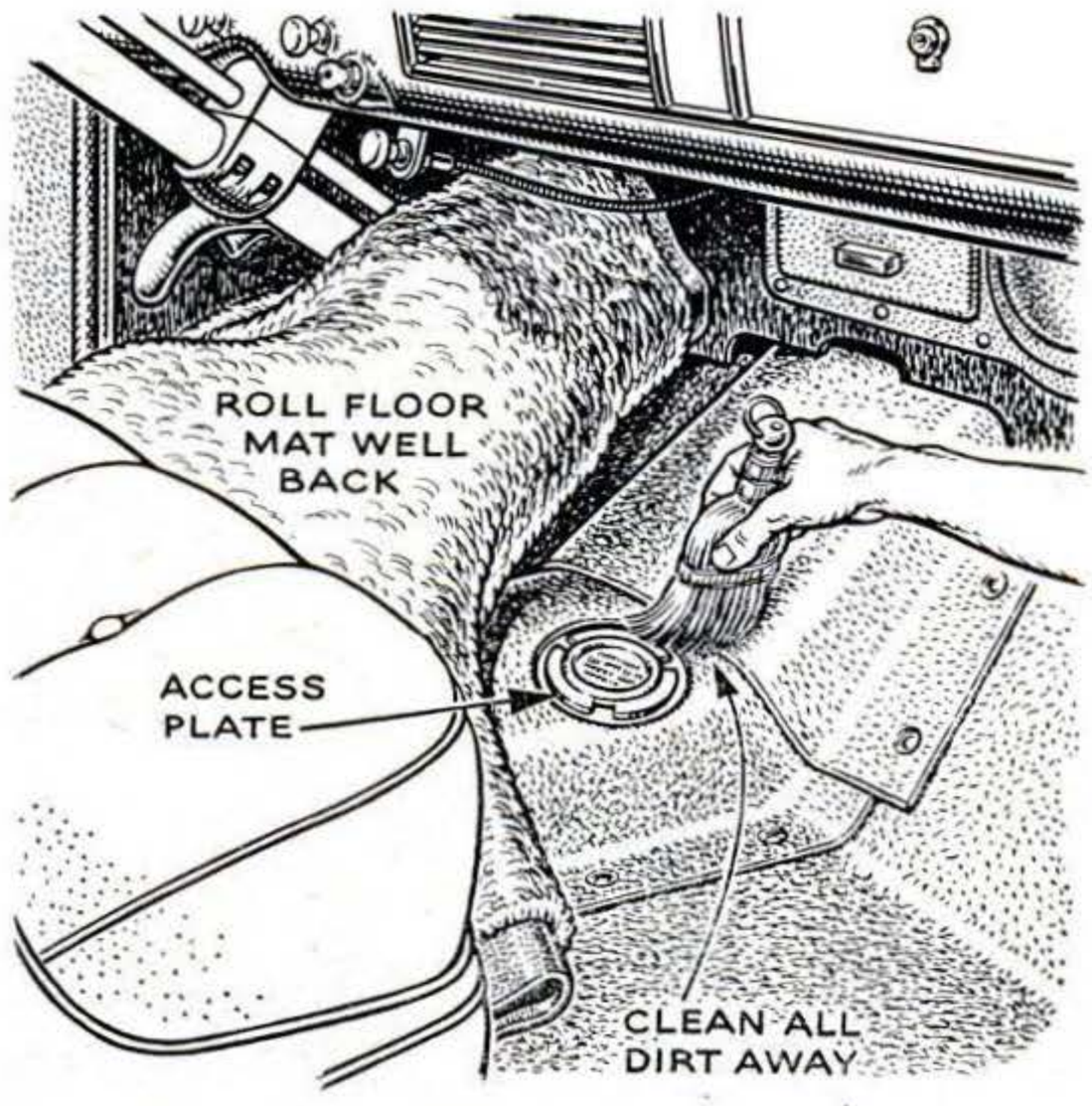
[*Continued on page 252*]

Hints from the Model Garage

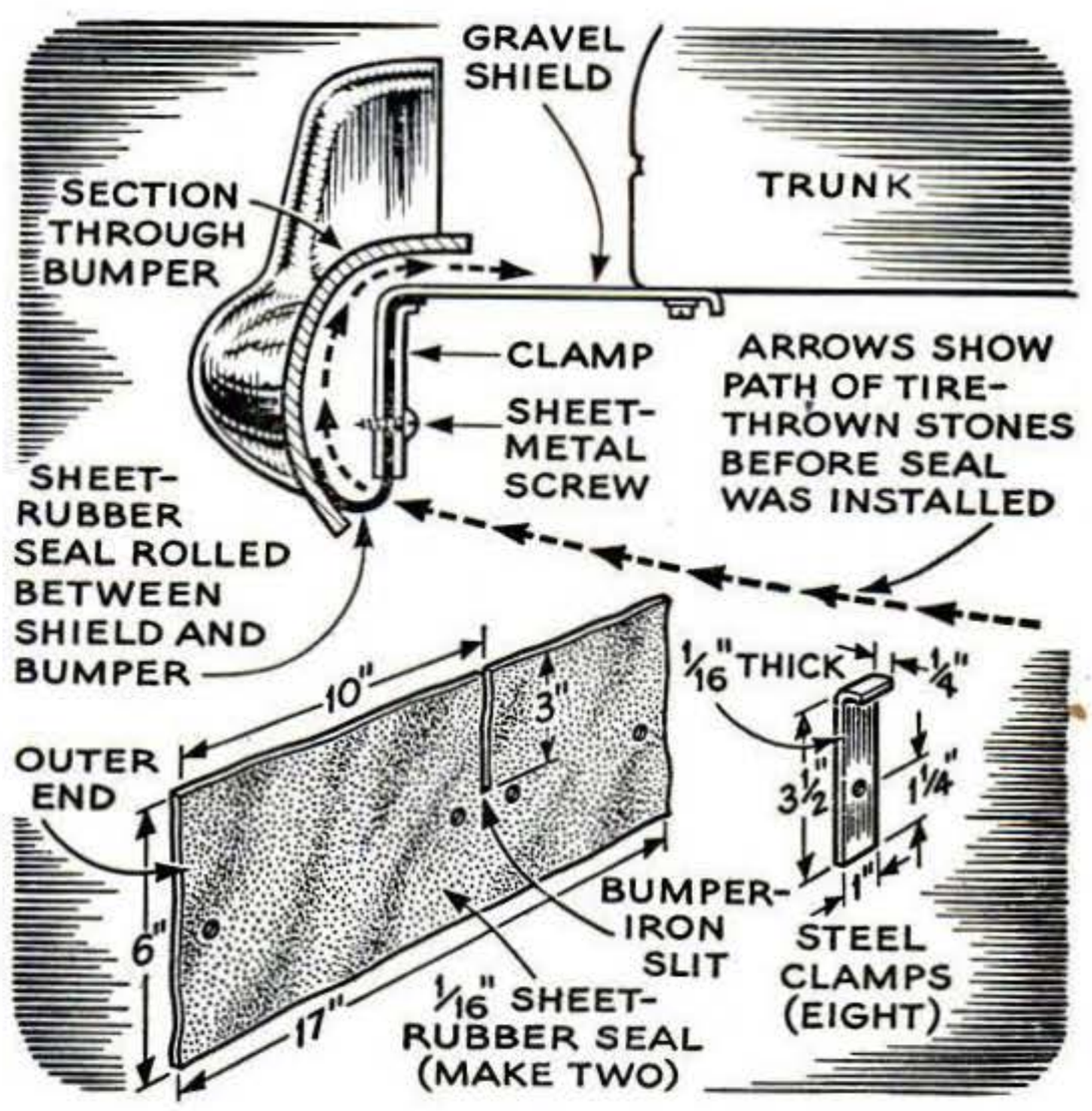


Replacing Tie-Rod Ends. When worn tie-rod ends are replaced, the following procedure will make it unnecessary to realign the wheels after the job is done.

Remove each tie rod from the steering assembly without loosening the clamps that hold the ends to the rod. About 6″ from the end, file a mark on the rod (1). Set a pair of dividers so one end is at the center of the seal over the end ball, the other at the filed mark (2). Turn up new end until it equals this measurement (3).



Keep Dirt Out of Transmission. On many cars with automatic transmissions, the fluid-level inspection plug and filler-tube are located where dirt collects. Make sure this is brushed away before the transmission is opened. Dirt dropped or washed inside the delicate mechanism can result in an expensive repair bill.



Shield Seal Stops Flying Stones. In at least one new car model, small stones thrown up by the rear tires collect on top of the rear gravel shield, marring the finish. Discovering that the stones were passing through the bumper-bracket slots and an opening between the shield and bumper, one owner installed the seal shown above.

Please turn the page for more auto hints.

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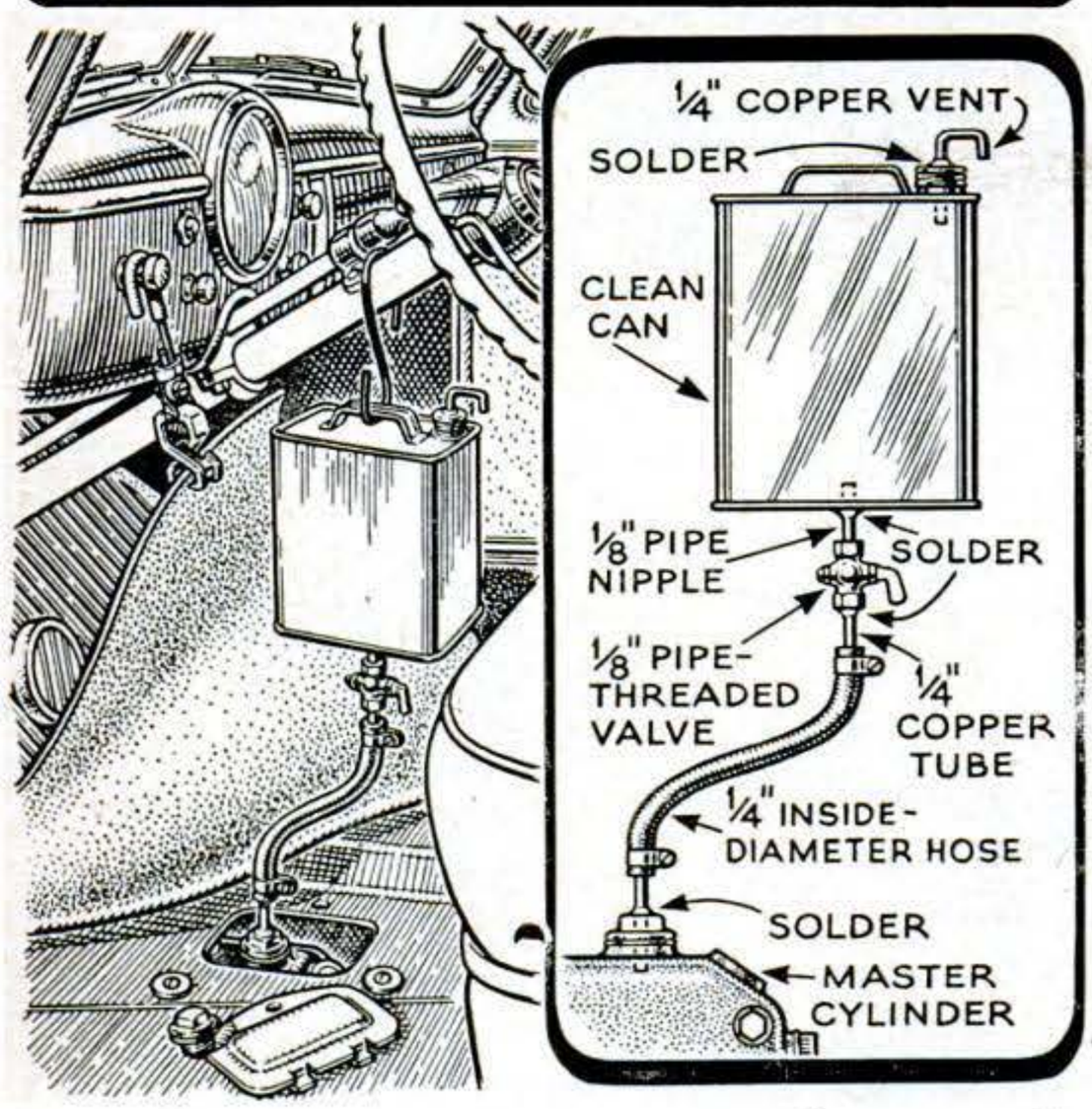
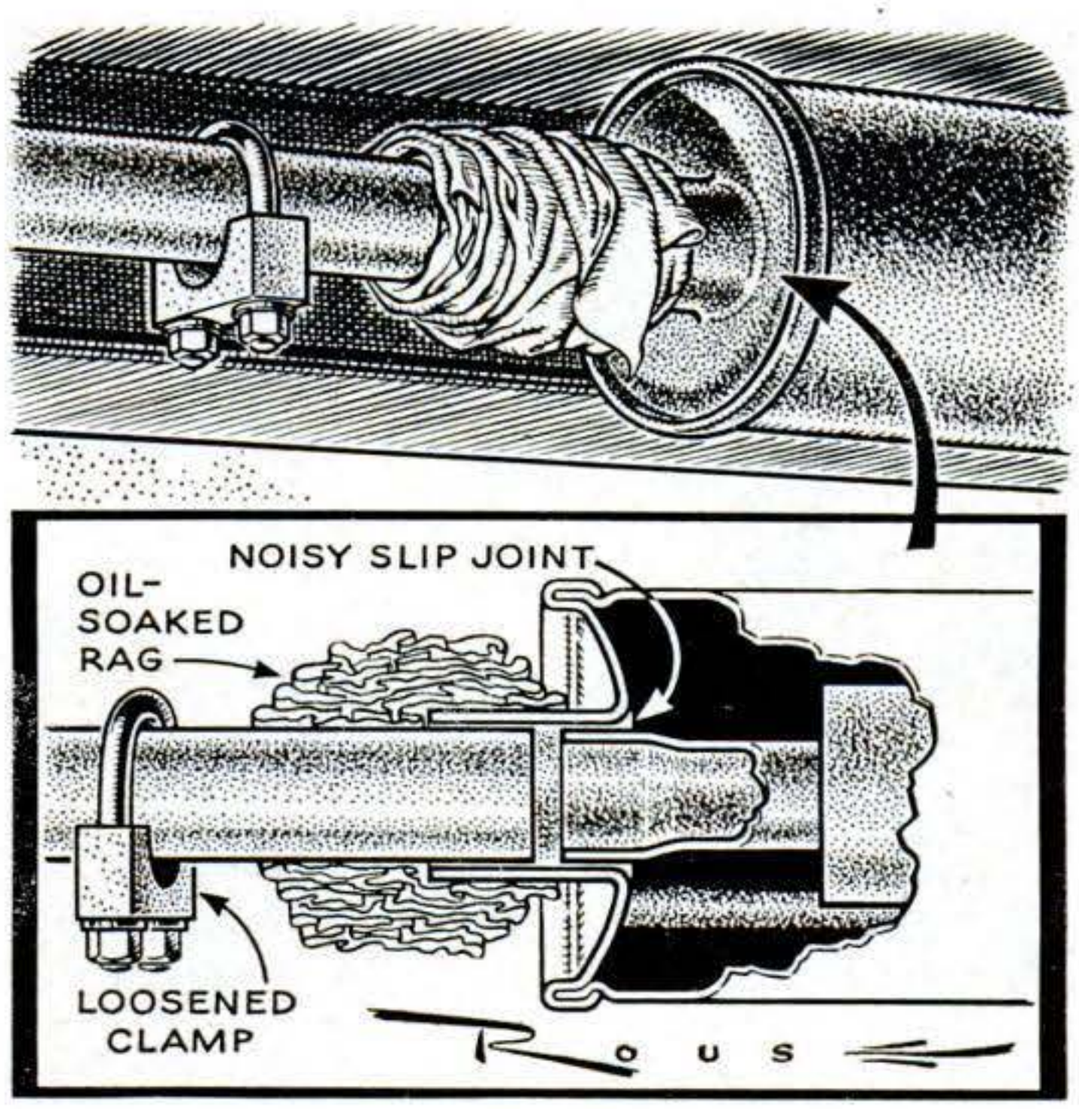
MORE Hints from the Model Garage



Bleeding Hydraulic Brakes. This rig will make it easy to bleed your brake system after a repair job. To assemble it, you'll need a spare cap for the master cylinder. Solder a piece of ¼" tubing into a hole drilled through this cap. You can also use the assembly to flush the brake system with alcohol.

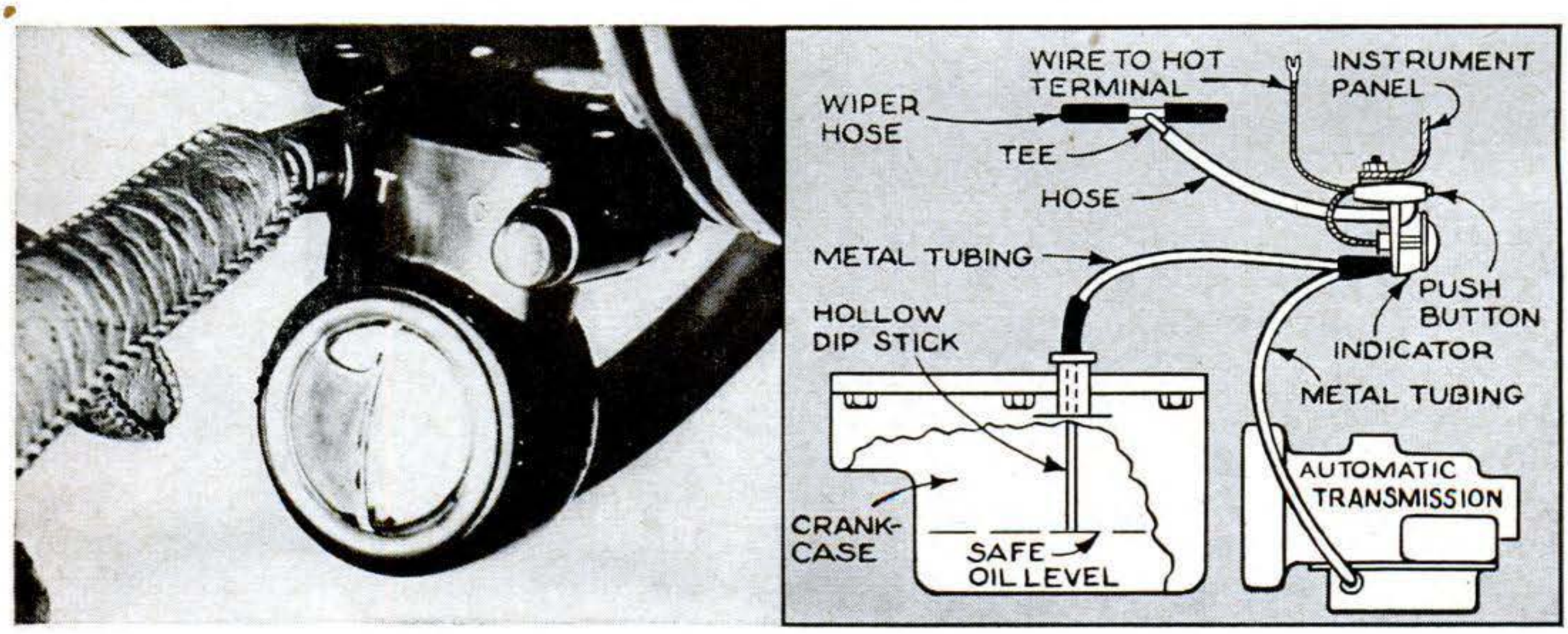


Oil Quiets Noisy Muffler. If noises come from a muffler slip joint, wrap the joint with cloth, saturate with penetrating oil, and leave overnight. If this fails, remove muffler and apply the oil. The oil cleans out rust that keeps joint from slipping properly when temperature changes expand or contract the inner muffler tube.

Dash Indicator Checks Level, Cleanliness of Oil

PUSH one button on this car accessory and you can see whether your crankcase oil is too low or too dirty for safety. Push another and you can also check the fluid level in an automatic transmission, if you have one.

When you press the button with the engine running, manifold vacuum draws oil into a glass-faced indicator. At the same time, a lamp behind the indicator lights up, showing whether the oil is clean or dirty. A hollow dip stick that comes with the Oil-Eye unit must be cut to equal the "low" mark on the regular dip stick. Thus, if oil drops below this level, none will show in the indicator. Oil-Eye Corp. of America, Winona, Minn., also makes units for crankcase use only.



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How to Tailor Your Christmas Tree

SAW OFF TRUNK close to the lowest branches and cut off the spindling section at the top of the tree.

FILL ANY BARE SPOTS with branches cut from rear of tree. Bore hole in trunk and insert branch with glue.

CLIP BRANCH ENDS. Start at top and step back often to check the work. Dab cut ends with dark paint.

BRACE LONGER BRANCHES that may sag by tying to branch above with fine, but strong black thread.

SHOPPING for a Christmas tree, you sometimes get the impression that most of them grew up in a narrow alley between tall houses. There's not much you can do with a tree that's skinny all around, but a reasonably fat one, even though unsymmetrical, can be redesigned to hide nature's slips. Start with a tree that's taller than you need. With a little judicious clipping and rearrangement of a bough here and there, as shown in the sketches, you can shape and groom it to taper gracefully to a point at the top.

To steady the tree, secure a wire or strong dark thread to the trunk, about a third of the way down from the top and run it to the picture molding on the wall behind or to a nearby door or window jamb. Fasten it with tacks.

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If Your Floors Sag . . .

Prop them up with jack posts or Lally columns before your home suffers major damage. Here's how to do it.

By Denis Sneigr

DOES your house have fallen arches? The arches, in this case, are the girders in the basement—the husky beams on which the floor joists rest. In many older houses the girders have sagged, with progressively increasing damage to the upper floors. Correcting a sagging girder is easy, especially if you catch it when it first begins to go. If you neglect it, the condition can only get worse and it may result in serious trouble upstairs.

The easiest way to bring sagging girders back to level is with jack posts. A jack post is made up of two lengths of telescoping steel tubing with an adjusting screw and top and base plates. You place the posts under droopy girders and turn the screws a little each week until the girders are level once more.

Wooden posts also can be used to bolster sagging girders. You first have to jack the girder up slowly, however, and then place the post under it. Builders and maintenance men usually don't put in wooden posts now because they are more troublesome to install and are subject to shrinkage and rot.

Why girders sag. There are many different ways the trouble can start. Perhaps the house was improperly built to begin with. Possibly the girders didn't have enough posts in the right spots. Maybe the basement floor has settled, letting down the posts that are already there.

Modification of the house—additions built on, partitions moved or new ones installed—also can cause girders and joists to sag because weight has been added or shifted around.

A settling foundation, shrinkage and warping of timbers, and rotted wooden basement posts also cause girder trouble.

Signs of trouble upstairs. When

JACK IT UP SLOWLY. Framing and beams that have sagged out of shape must be jacked up slowly to avoid damaging the house.

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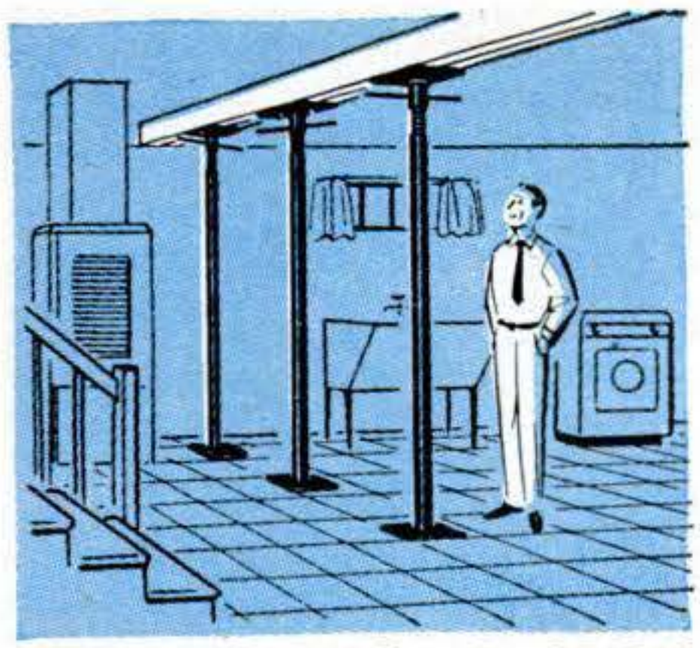
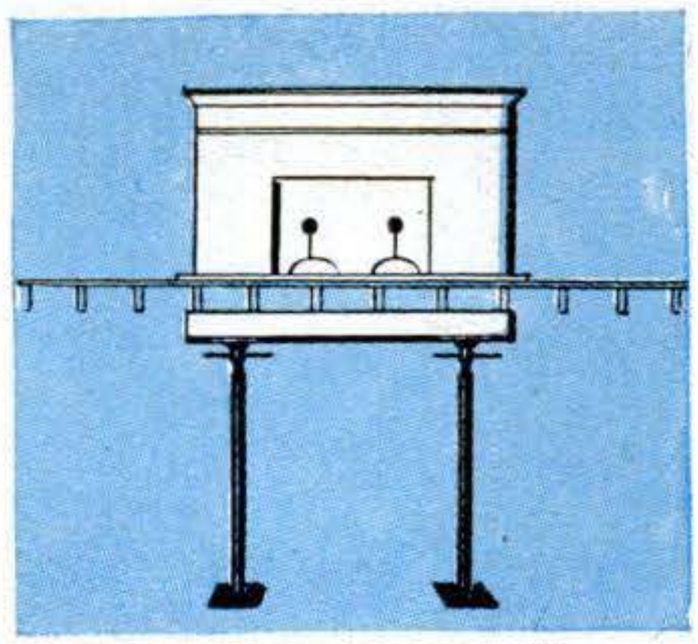
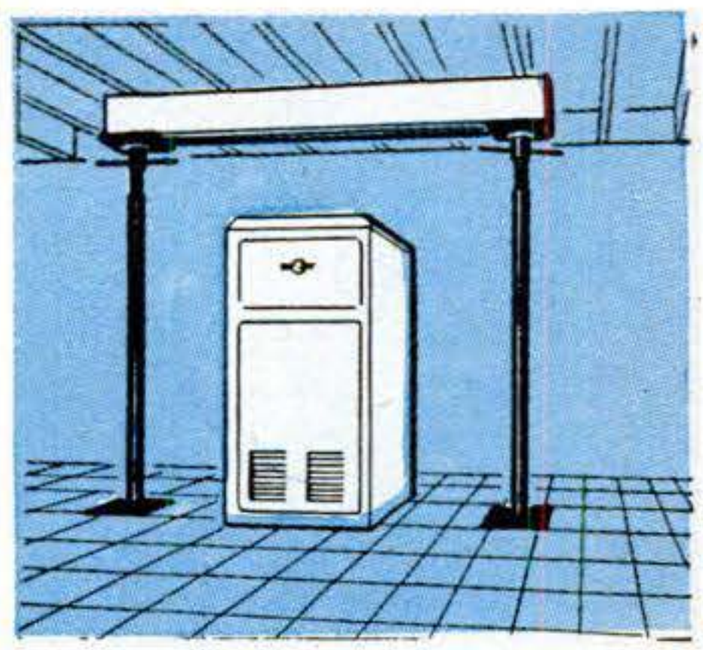
Six Spots in Your Basement That May Need Jack Posts



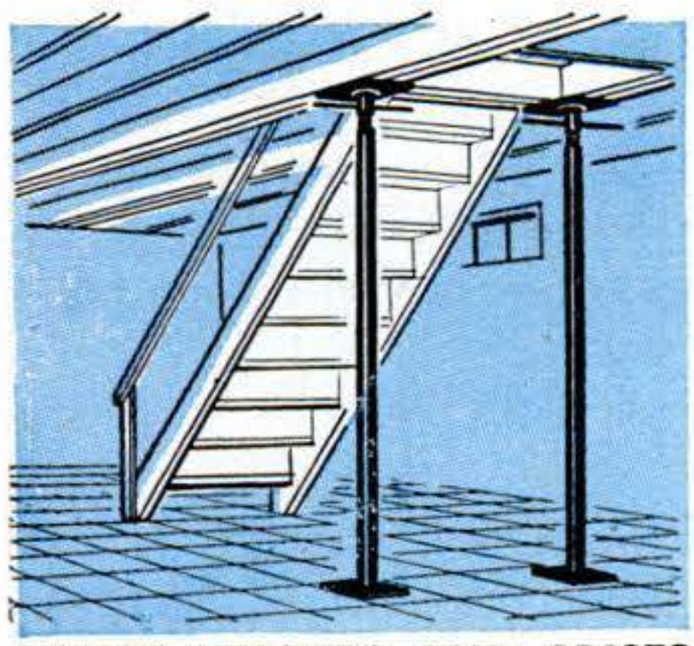
UNDER GIRDERS OR BEAMS that have sagged or to replace rotted wooden posts.



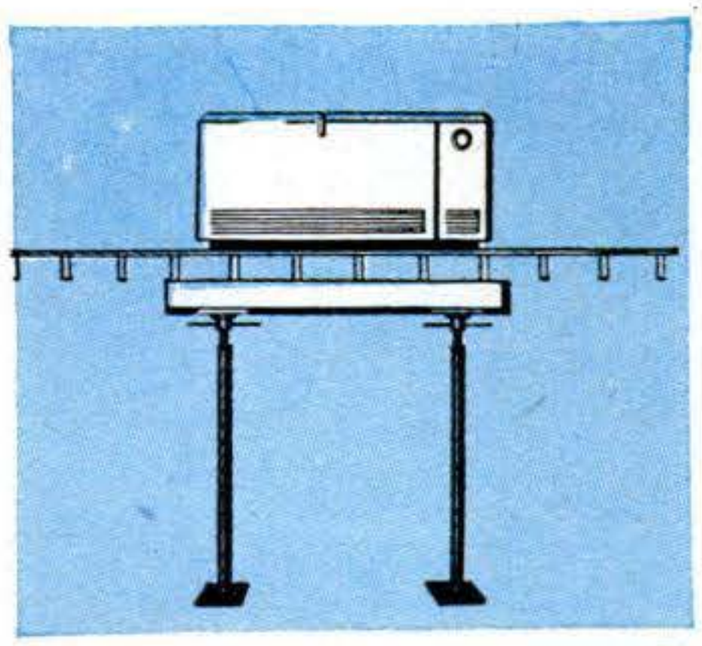
UNDER A FIREPLACE. Put extra beam under the joists and use two jack posts.



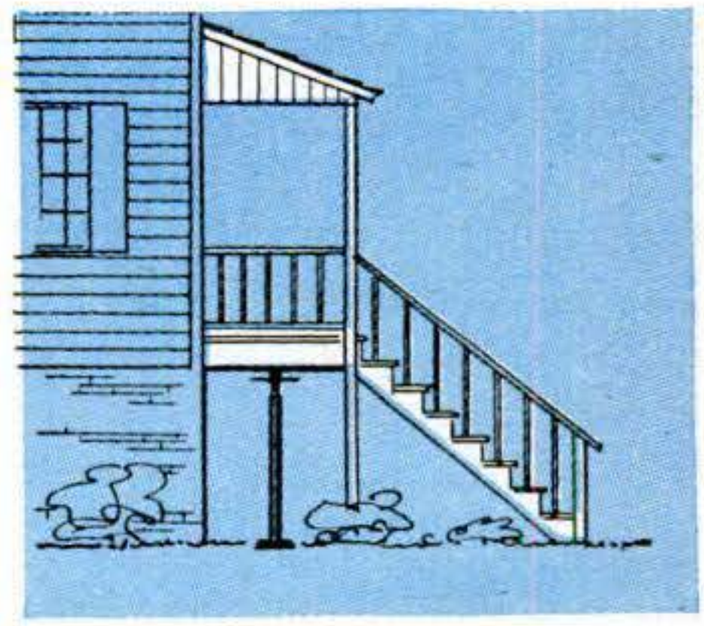
UNDER JOISTS that are above a heating plant. Heat often affects joists and flooring.



UNDER HEADERS AND JOISTS around stairs. Cracks in plaster indicate need of support.



UNDER HEAVY EQUIPMENT, like a freezer. Put in Lally columns before freezer.



UNDER PORCHES. Put in concrete footings before placing jack posts.

girders begin to sag, you'll usually see some or all of these signs in the upper rooms: cracked plaster, sticking doors and windows, sloping floors, and floors that don't feel solid when you walk across them. If you let girder trouble go long enough without correcting it, even the roof of your house may begin to sag.

Shrinkage of joists and of the plates at top and bottom of partition studs can also cause similar but milder difficulties. However, there is little you can do about correcting this, since shrinkage is common to almost all frame houses.

Checking the signs. Use a long mason's level to check the flooring. If you use a short level, buckled flooring may fool you into thinking the floor is sloping.

In the basement, examine the girders closely. Inspect every spot where a girder is spliced or meets any other member, looking for signs of separation. Also check the girders with a line level or a long level. If you don't have a mason's level or a line level, get a 6′ piece of one-by-two that is straight and clamp your level to it. The dip in a girder may be so slight that a 12″ or 18″ level wouldn't show it because the level wouldn't have enough bearing surface.

How to use jack posts. Several companies make these adjustable steel supports under different trade names, and you can buy them from hardware stores, lumberyards or mail-order houses.

Place the post under the girder. Adjust the telescoping sections until the top plate is touching the girder or as close to it as the adjustment will allow. Then rotate the screw until the top plate bears against the girder. Check the post with a level to be sure it isn't cocked. Then turn up the screw until the post begins taking up some of the load.

But take it easy. All jack posts should be turned up slowly. When the timbers in your house begin to sag, it is a gradual process. Little by little, the girders and framing members are pulled out of line. Jacking up a sagging girder slowly gives the structure a chance to resume its normal shape.

If you jack a sagging girder up to level too quickly, you can crack it and other framing members, do further damage to cracked plaster, open old cracks wider, and

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BRIDGE JOISTS WITH A BEAM and put a jack post under beam. If you bridge more than three joists, put jack posts at ends of beam.

even cause a whole plaster wall to fall.

Other dangers of fast jacking are leaks in plumbing and gas lines. Even when you follow directions and jack up slowly, it's a good plan to watch gas and plumbing lines for leaks.

Do you need footings? You can't always trust a cellar floor as a bearing for a post. It depends on the thickness of the floor and the fill and soil under it. If your home was built fairly recently, you may be able to determine floor thickness by checking the local building code. It's not uncommon to find cellar floors as thin as 1½″ or 2″—too weak to take concentrated loads.

If you find that you need footings for your posts, or if you want to play safe, here's how to put them in:

Break a hole 2′ square in the floor and dig it out at least 1′ deep. Fill it with this concrete mix: four parts gravel, two parts sand and one part Portland cement. Let the concrete set at least three days before installing the post. You can finish the footings flush with the floor or raise them an inch or two.

Bridging joists. Sometimes the joists themselves will sag, especially where they have a long run or have lapped splices. One treatment is to put a new beam *under* the sagging joists and put jack posts under the beam. A length of four-by-four, channel iron or an I beam will serve. If you are going to bridge more than two or three joists, use at least two jack posts.

Where to use Lally columns. If you are going to bring into your home an unusually heavy piece of furniture or equipment—piano, home freezer, big refrigerator—you can first strengthen the floor beneath by installing Lally columns to forestall any sagging.

A Lally column is a length of steel tubing filled with concrete. It has top and base plates. Lally columns are not adjustable. They are usually employed in new construction, but can also be used under sagging girders and as replacements for old wooden posts. END

TACK RAG

IN varnishing and enameling furniture and other woodwork, it is vitally important to keep the surface clean just ahead of the brush. A practical means of doing this is to use a so-called "tack rag." This may be purchased or made. Preparation: Use lintless cloth such as an old handkerchief, which is good because of its hemmed edges. Dip it in water, wring quite dry, then sprinkle lightly with varnish. Refold and rewring so the varnish permeates the cloth. Keep it rolled in oilcloth or waxed paper when not in use to prevent drying out. Should this occur, sprinkle with water and wring out again.

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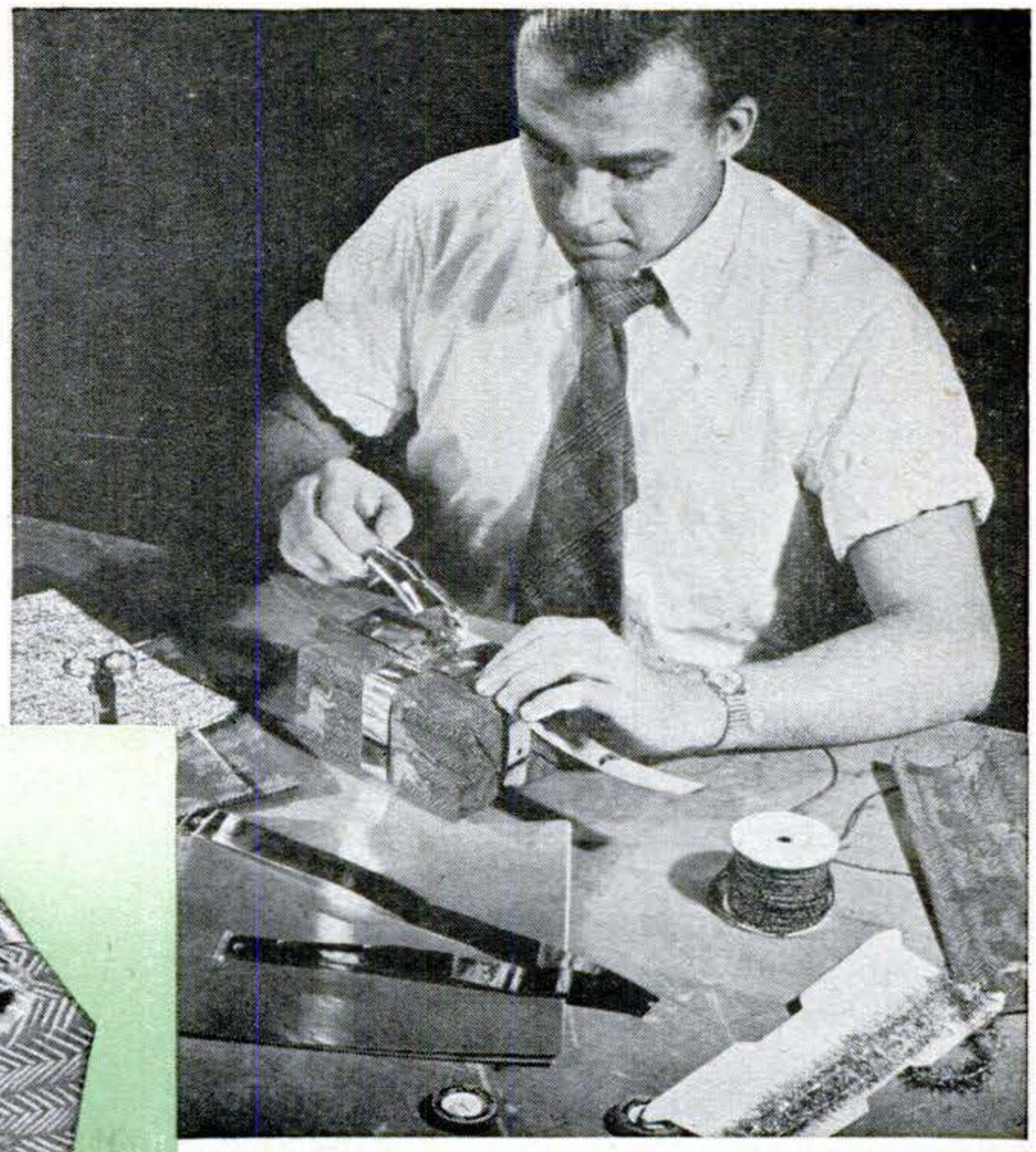
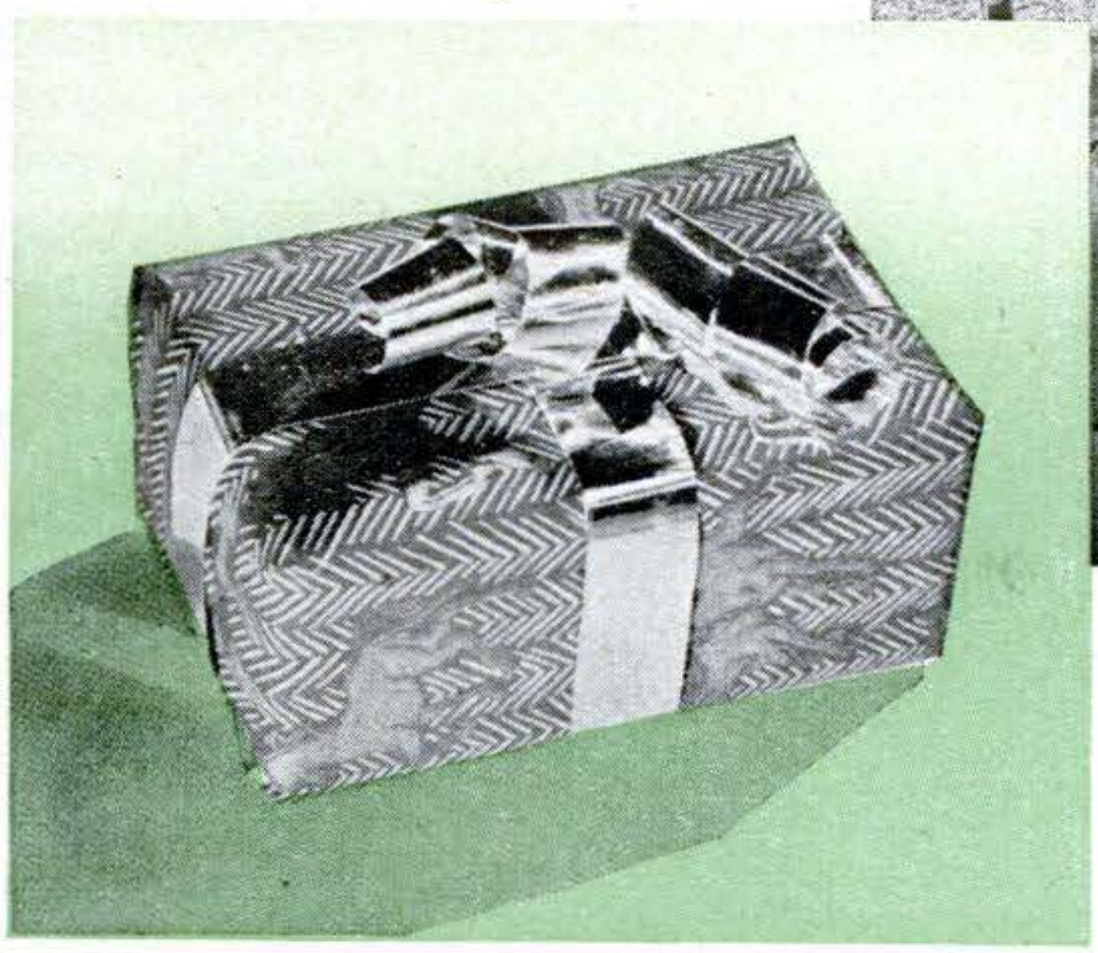
You Can Wrap 'Em Without Bows

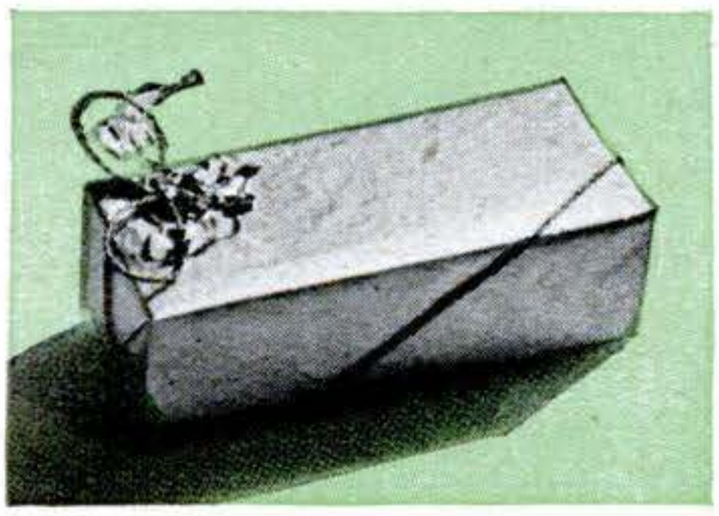




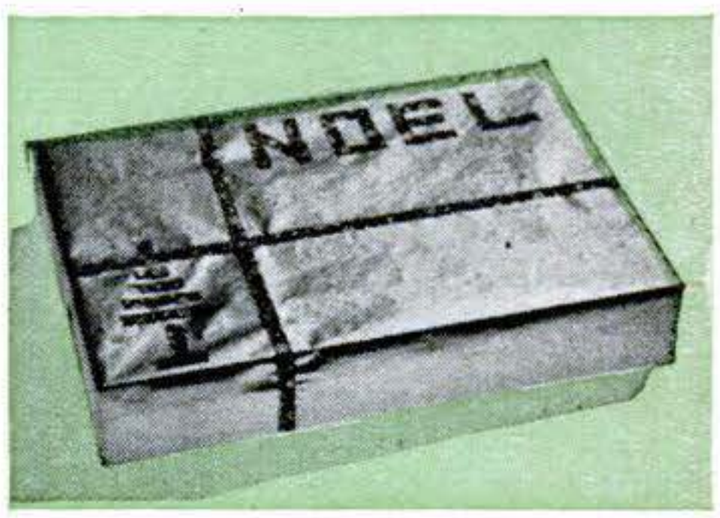
SHINING METAL PIPE BANDS, hitched together and used in place of ribbon, make an unusual touch. (They're the kind that hold insulation on steam pipes.) Pull the strap tightly across the package and fold back the end firmly. Also do it lengthwise. Now roll up the ends into coils and draw out in spirals.

MOST men bungle the job of gift-wrapping because they're all thumbs when it comes to whipping a length of ribbon into bows and rosettes. But if you eliminate the ribbon you can dress up a gift so it won't look as if it was wrapped in the dark.

Metallic papers usually have enough body to fold crisply. Tack down each fold with a bit of cellulose tape as you work. Finish off with one of the crossties shown here, which can be managed by practically any heavy-handed male.

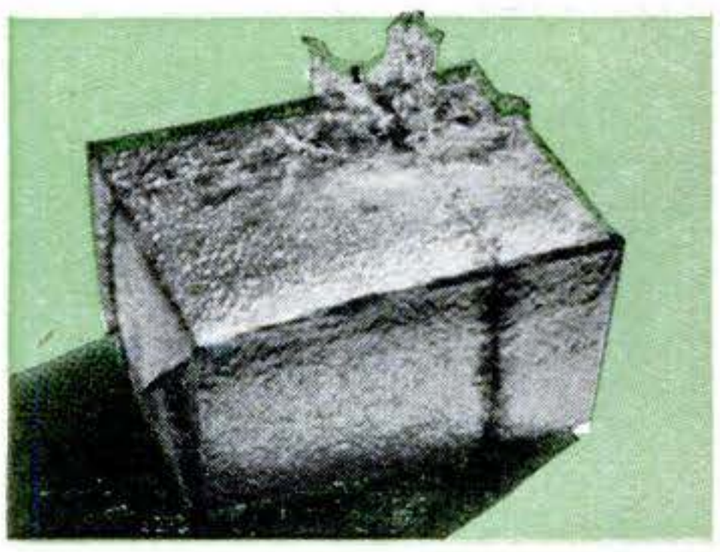


HEAVY METALLIC CORD ties as easily as thick grocer's twine. A sparkling ornament covers knots.



GIFT-WRAP TAPE pressed down neatly makes a smooth package. Greeting lettered with tape is good.

METALLIC FLAKES, sprinkled over masking tape that was applied sticky-side out, give lots of extra glitter.



SILVER TINSEL over silver paper doubles the glamour. Loops of tinsel tied into the knot finish off the job.

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Cats Are Fun to Photograph

An expert reveals tricks that help you get good pictures of Tabby. Patience is the biggest requirement.

By Walter Chandoha

CATS are easy to photograph—if you can tap an unlimited supply of patience. Beyond that, all you need is a camera (I prefer a reflex) with flash attachment. An assistant, portrait lenses, a tripod and a flash extension are helpful, but by no means essential.

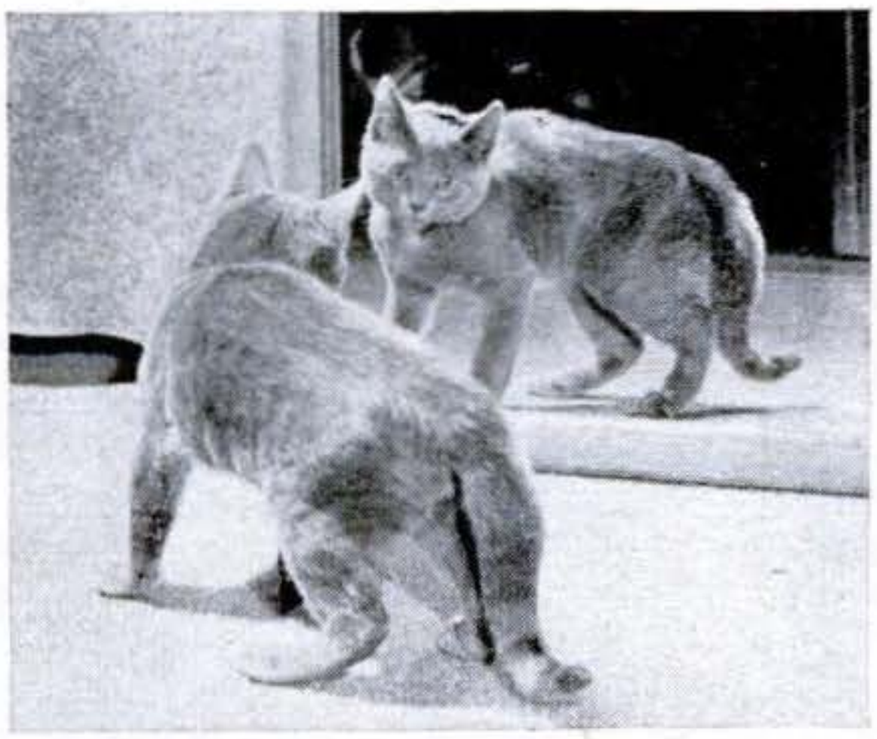
The best place to work is a spot the cat likes best and the best time is just after he has eaten. When the cat gets down to the business of washing, you can start clicking. Set up your equipment beforehand and keep backgrounds plain. If the cat happens to like a spot in front of a cluttered background, stretch a sheet behind him.

Make silly noises to get Tabby's attention: miaowing, barking, hissing, squeaking, crumpling paper, or whatever you think might work. If the cat is uncooperative, a morsel of shrimp, liver, catnip, ground beef or sardines will bring him around. Shoot while he is looking for more.

You can use flood or daylight, but I favor flash bulbs. Their strong light enables you to use a small aperture and a high shutter speed—both requisites for getting good pictures.

An aperture of f/22 will give you sufficient depth of field so that any slight error in focus will automatically be corrected. And if your focus is right on the nose (you should take that literally—focus on the nose and whiskers rather than on the eyes) you'll get an over-all sharpness that is desirable. As for shutter speed, remember that the closer you get to a moving object the faster your shutter will have to be. Working about three feet from a cat, I find that 1/250 second stops all but the fastest motion. END

These are photos by Walter Chandoha, a specialist in cat pictures. Hundreds of cats have cavorted before his camera, and the results have been widely published.



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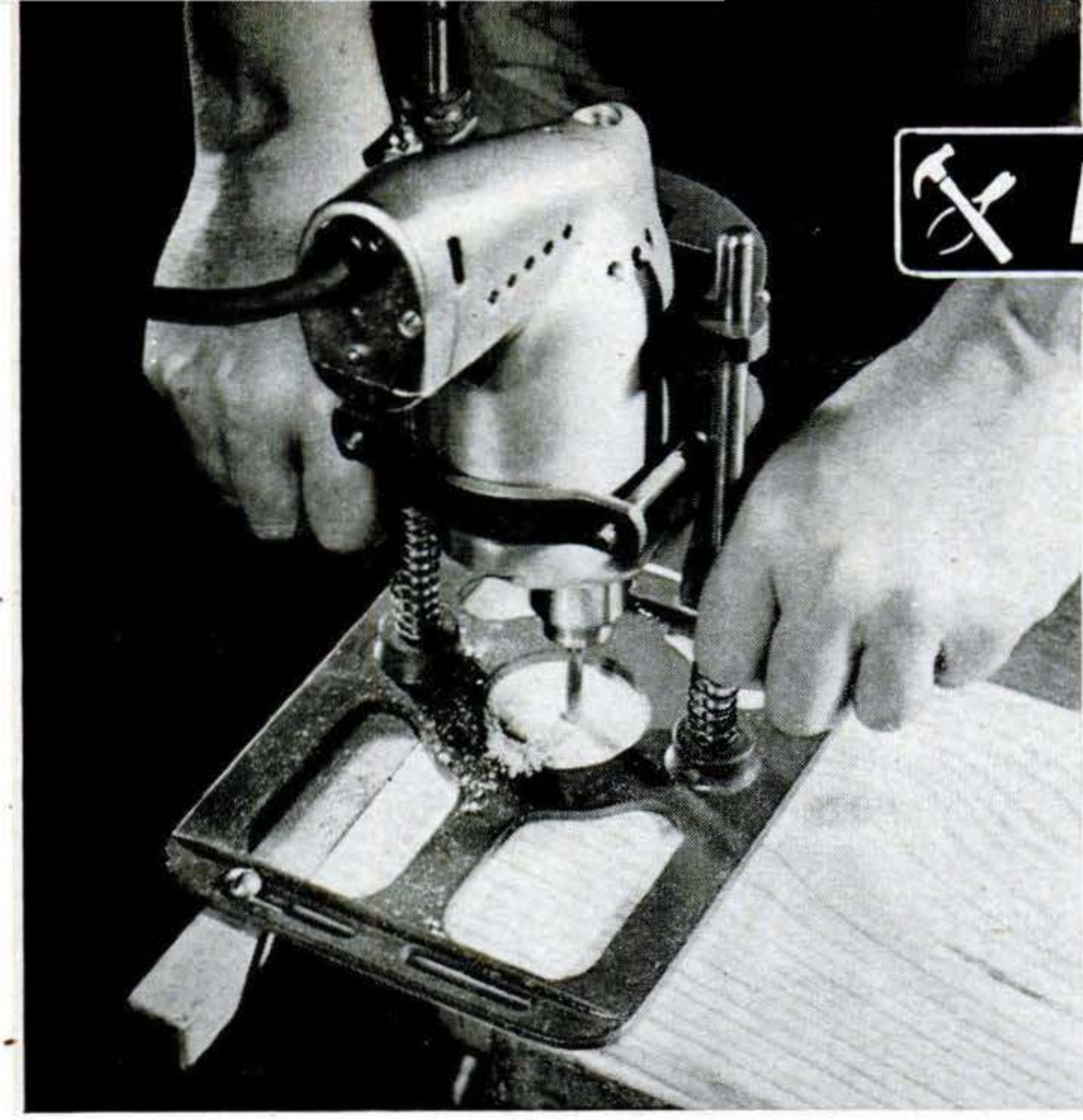
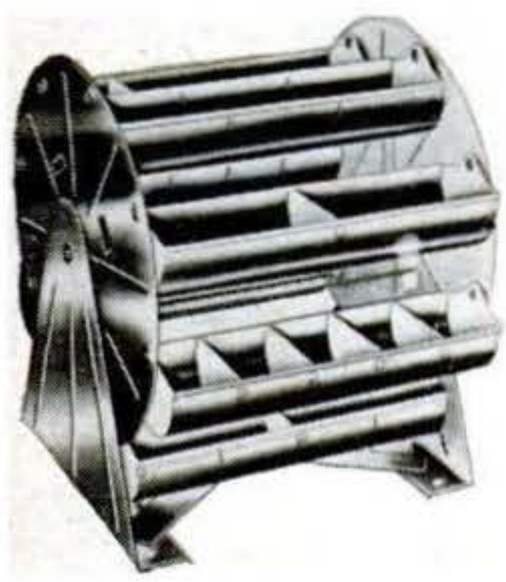
New Tools



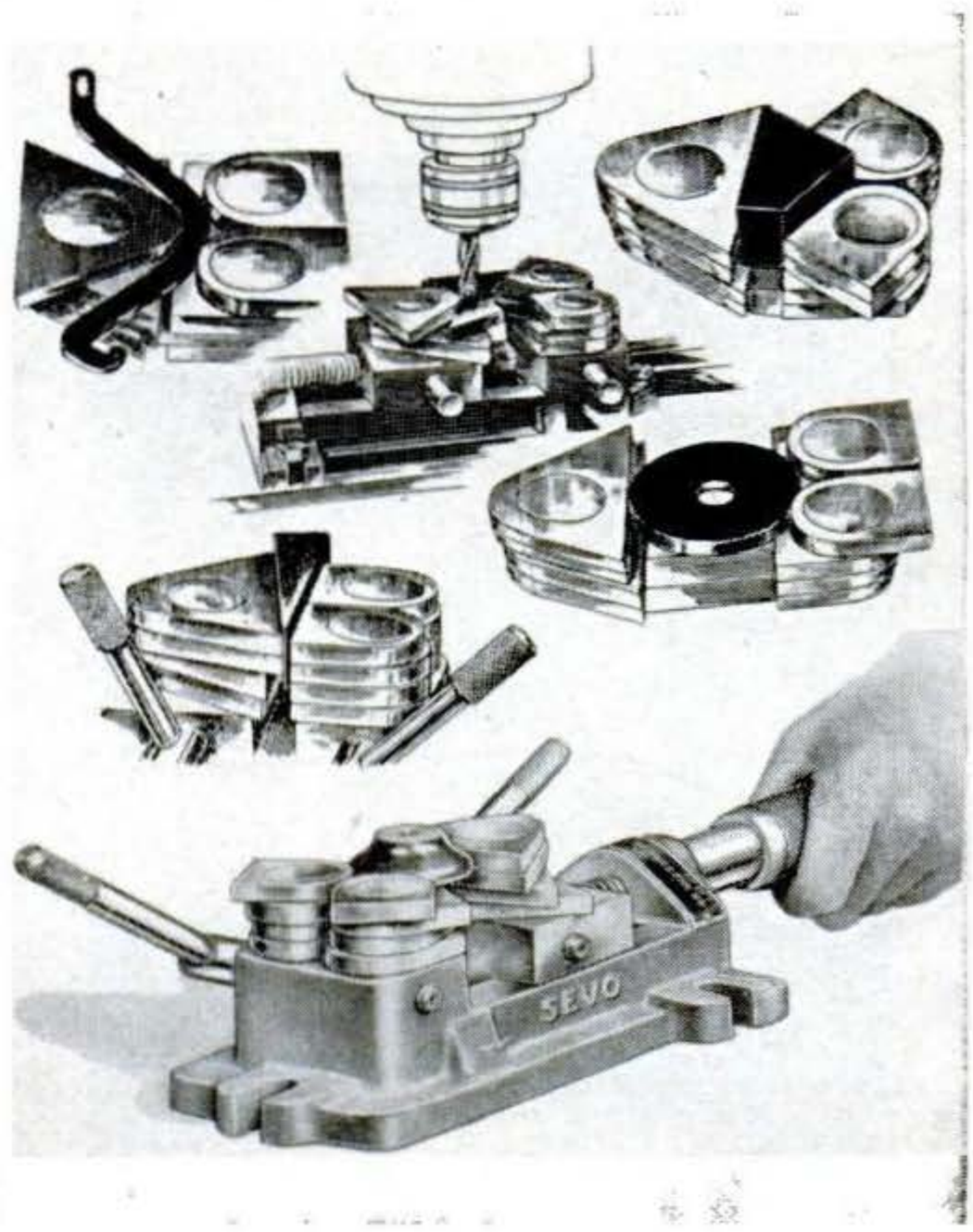
Drill Powers Router. A ¼" electric drill can be converted to a portable router with this attachment, which cuts grooves, rabbets, tenons and mortises. You can follow a pattern line with it or use one or two adjustable fences. A gauge controls the depth of cut. The two-handed grip gives the operator good control. A 3/16" router bit is included with the attachment. Other bits—⅛" and ¼"—are available as extras. *Bertram Engineering and Supply Co., Kansas City, Mo.*



Parts Bin Revolves. Because it can be revolved like a Ferris wheel, the bin at left makes small parts readily available. It is made in two sizes, with 28 or 46 bins. *H. J. Manufacturing Co., Linwood, Mich.*

Vise Clamps Irregular Work. The jaws of this Swedish-made vise consist of three groups of flat-ground plates that can be moved in relation to each other to suit the work, and set so that the work can rest on a contact surface underneath. Then they can be locked to retain their relative positions, and the main screw advanced to hold the work. The drawings below show how it holds work of various shapes. The Sevo vise comes in two sizes, with 2½" or 5" between jaws. *De Wilde-Jones, Inc., San Francisco.*

Open Sockets Have Ratchet. This wrench can be slipped on tubing, rods or studs and then down onto the nut or fitting to be turned—both the ratchet head and the sockets have open sides. Ratchet arcs are small—7½° on most sets and 5° on the largest set. Six sets are available, covering socket sizes from ⅜" to 4" in increments of 1/16". *Tubing Appliance Co., Los Angeles.*



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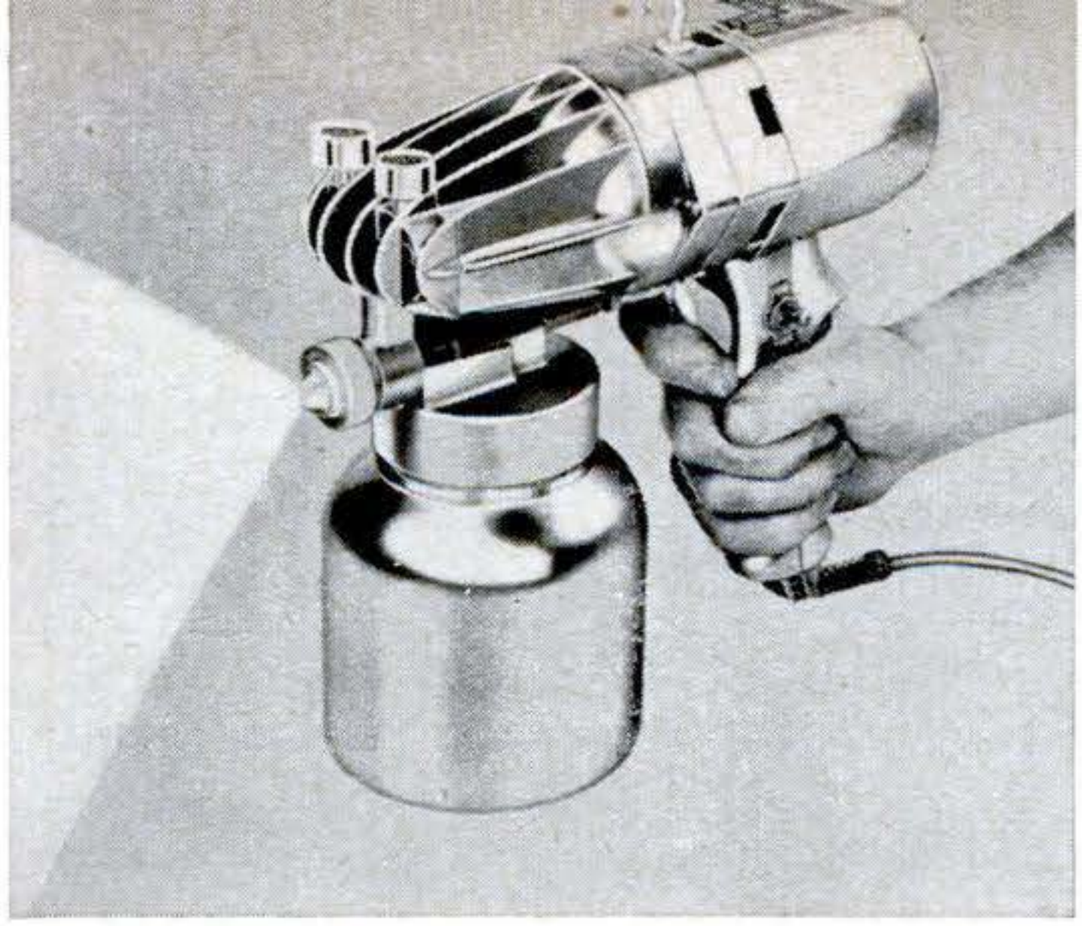
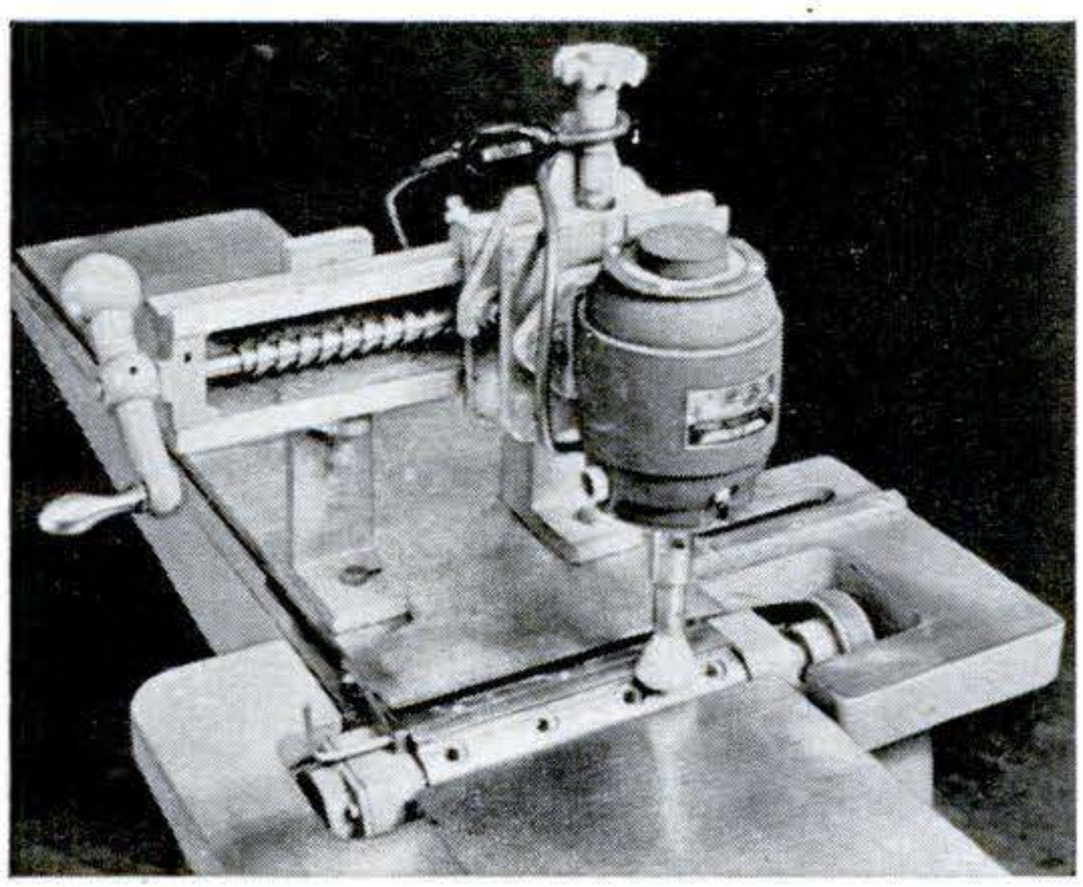
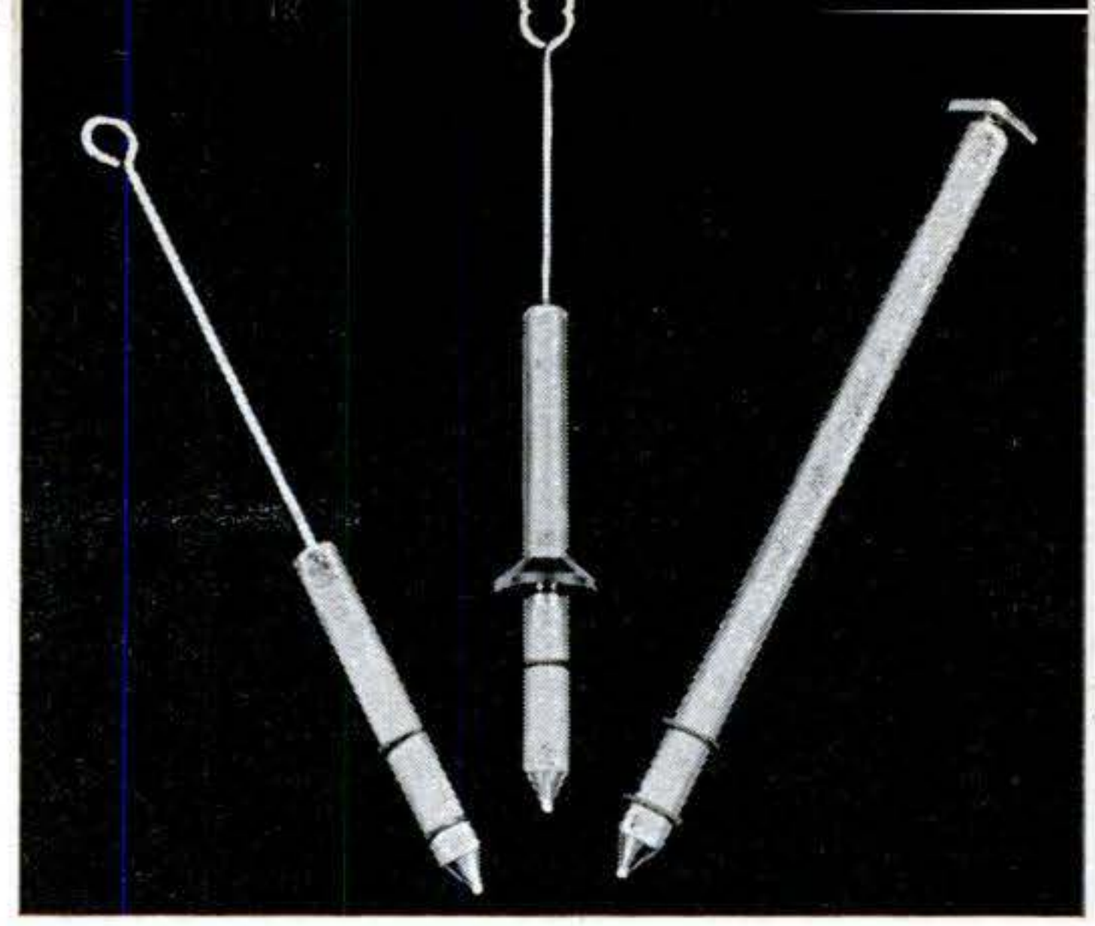


Spray Gun with Built-in Compressor. A complete spray-gun system, including a 10,000-r.p.m. motor and a dual-piston compressor, is built into this 17-lb. unit. It will spray one quart in four minutes at 50-lb. air pressure. Included with the gun are extra aluminum canisters, three nozzles, and strainers, plus a carrying case. *Kapner Hardware, New York City.*

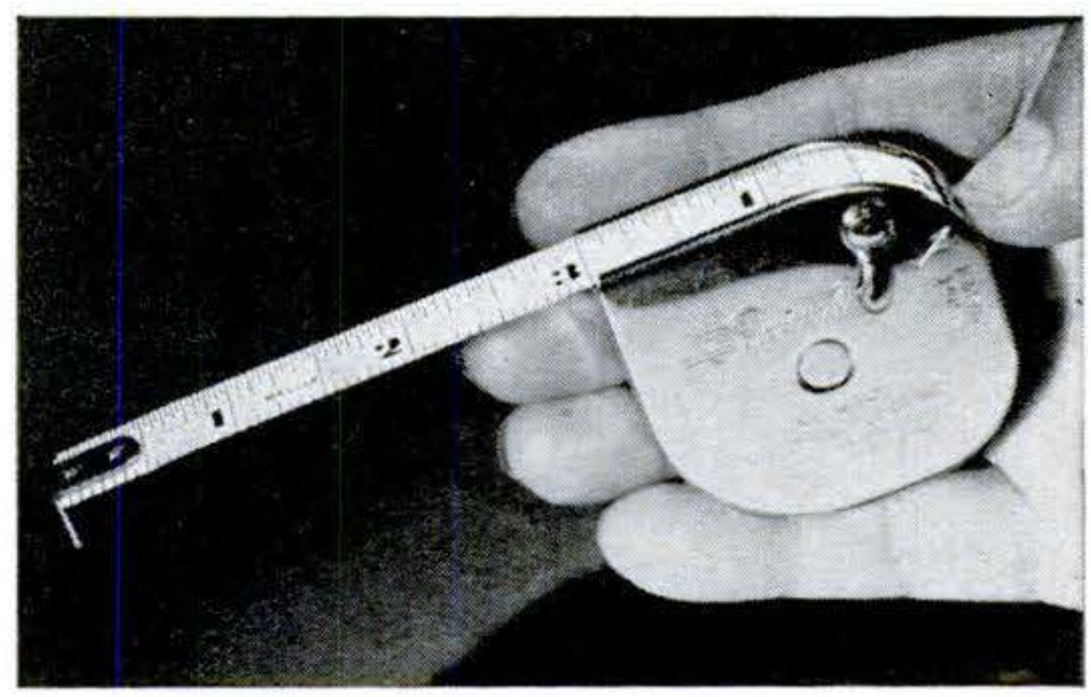


Attachment Sharpens Jointer Knives. Without removing the cutterhead from the machine, you can quickly sharpen the knives with this motor-driven grinder. It is made for Delta 8″ jointers. The jointer is furnished with a table that is drilled and tapped to take the attachment. Proper grinding angle is obtained by placing a pin through the stop bar and into the head. A crank turns a lead screw that draws the grinding wheel across the knives. *Delta Power Tool Division, Milwaukee.*

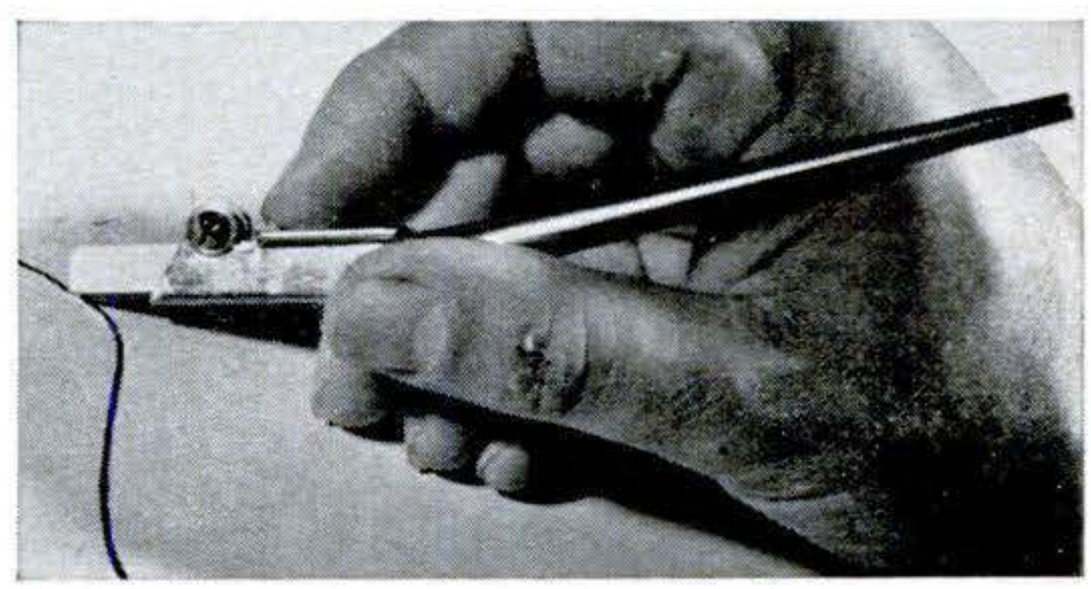
Knife Holds Injector Blades. New or used injector-type razor blades can be used in this knife. When part of the blade becomes dull, it can be broken off and a new part of the blade extended. *Korbin, Inc., Hickory, N. C.*



Magnets Pluck Chips from Castings. These magnetic tools are designed for entering small openings, such as blind holes, to remove boring chips. The nonmagnetic brass tip and neoprene bumper rings prevent the tool from grabbing the bottom and sides of the hole. Some models have a release pull that dumps the chips off the tool. Chips are removed by hand from other models. Diameters of the five different models are 1/16″, ⅜″, 1⅜″ and 2⅝″. *Multifinish Manufacturing Co., Detroit.*



Tape Locks to Measure Inside. An arrow on the case of this tape indicates the distance between the end of the tape and the edge of the case, simplifying inside measurements. A lock on the side of the case holds the tape at any point until released. The tape, which has a decimal conversion chart, is made in 6′, 8′ and 10′ lengths. *Master Rule Mfg. Co., Middletown, N. Y.*



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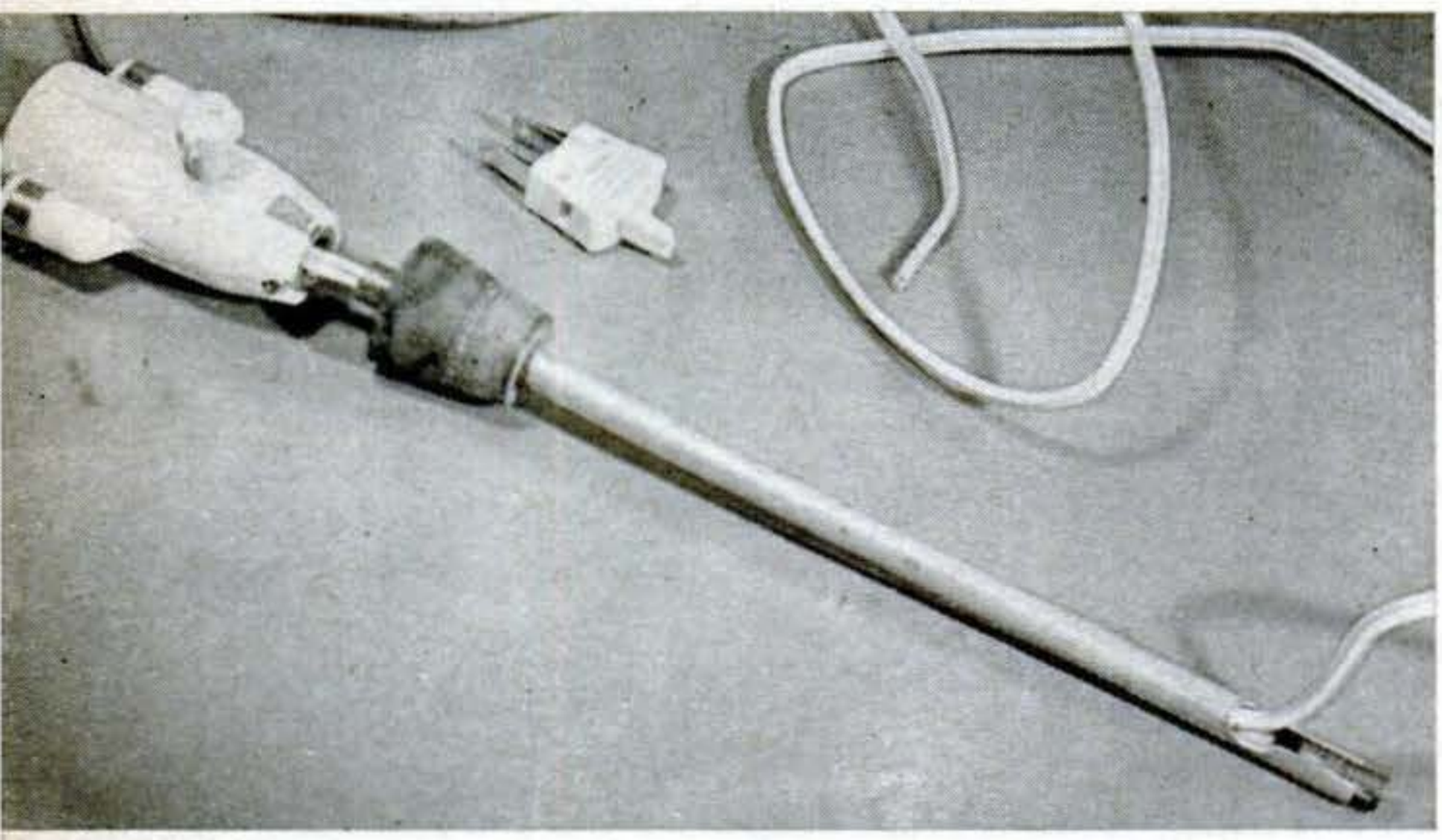
One-Evening Gift Projects

Kit Plus Jug Equals Lamp. An old stone jug or bottle and a wiring kit for one of the new three-way indirect bulbs add up to this colorful table lamp.

The first step is to drill a hole for the lamp cord near the base. You could avoid this chore with a side-outlet socket, but the wire is then likely to be a nuisance. With either a carbide-tipped drill bit or an electric vibrating tool, you can quickly put a hole in glass or glazed ceramic material. If you don't have this equipment, use your hand drill or drill press as shown in the photo at left below.

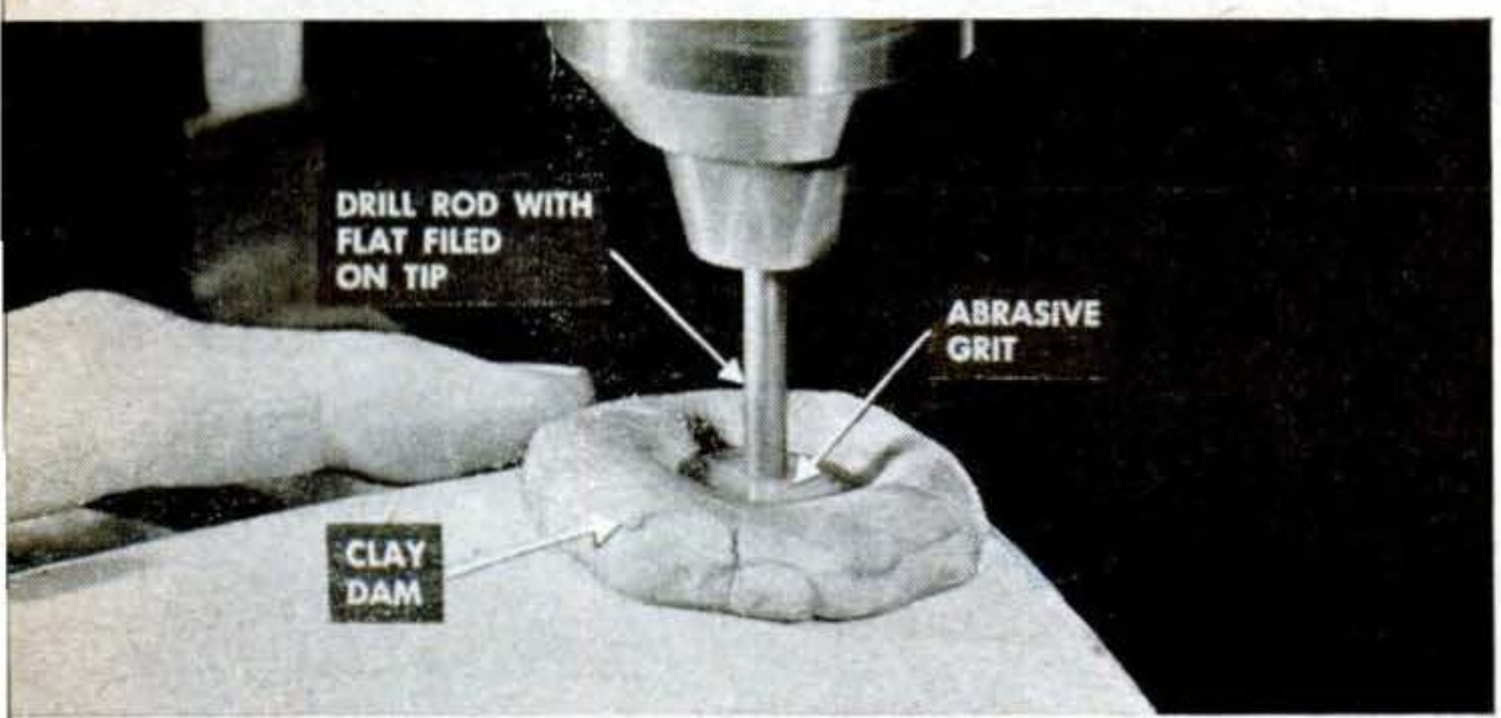
Make a puddle of kerosene, water, or turpentine containing a few pinches of abrasive grains, and run the drill at fairly low speed. Withdraw it frequently.



The socket, wire and plug shown are part of a ready-made, prewired kit sold for use with three-way mushroom-shaped indirect lamps. You can use a similar kit or assemble your own parts.

To attach the socket assembly, use a length of ⅛" pipe threaded at the top. Make a hole through the center of a cork with a cork borer or a spur-center machine bit. Drill and notch the lower end of the pipe as shown. Insert a tight-fitting wooden plug in the notched bottom and press down on the pipe, cork and plug until the top is in place and the plug rests solidly on the bottom. Pull the pipe assembly out and make a knot in the lamp cord larger than the hole in the jug. This will keep the pipe from being tilted by a tug on the cord. For further security, you could use rubber-covered wire and pour in an inch of plaster on final assembly. Cement a felt disk to the bottom.

Building time: 1½ hours.



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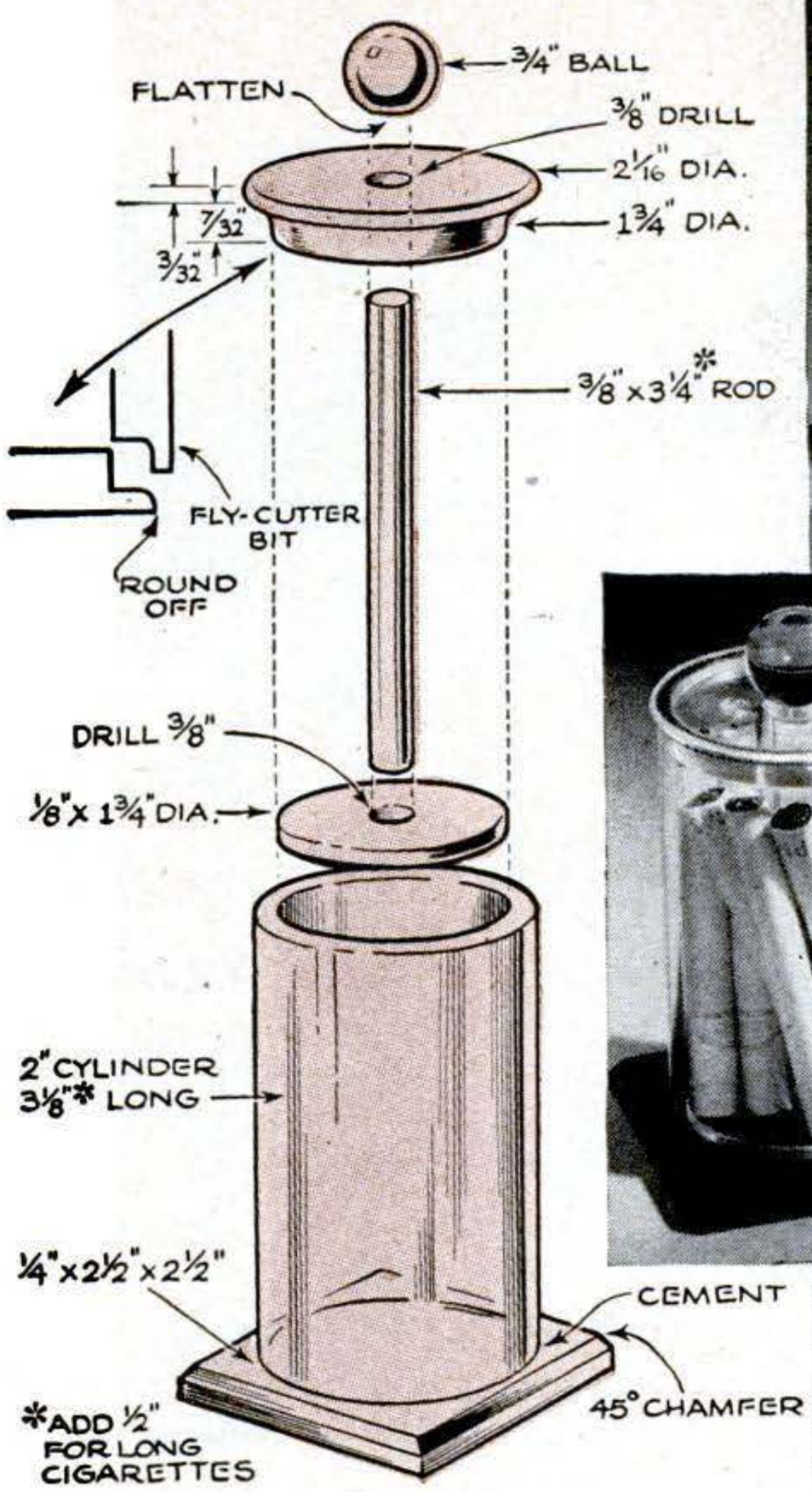
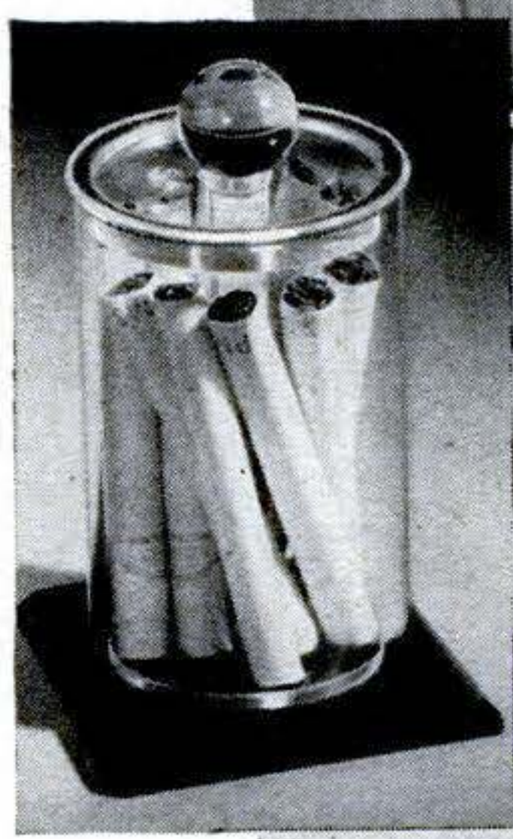




Cigarettes Rise With Lid. This container pops cigarettes up when you want them. At other times it keeps them covered. It is made of transparent acrylic plastic so you can tell at a glance when you are running low.

The body is cylinder stock 2″ in outside diameter. The bottom disk—the cigarette carrier—is ⅛″ sheet. It can be sawed out and filed or sanded, or formed with a fly cutter on the drill press. With a notched cutter bit you can cut out and flange the lid in one operation, as shown in the drawing. You can also turn it on a lathe or cut one disk from ¼″ sheet, a second from ⅛″ stock, and cement the two together.

Drill the lid and bottom disk for a piece of ⅜″ rod, and cement it into both. The handle may be a ball, a bow, or a bit of rod. If you enjoy internal carving, the handle is a good spot for it.

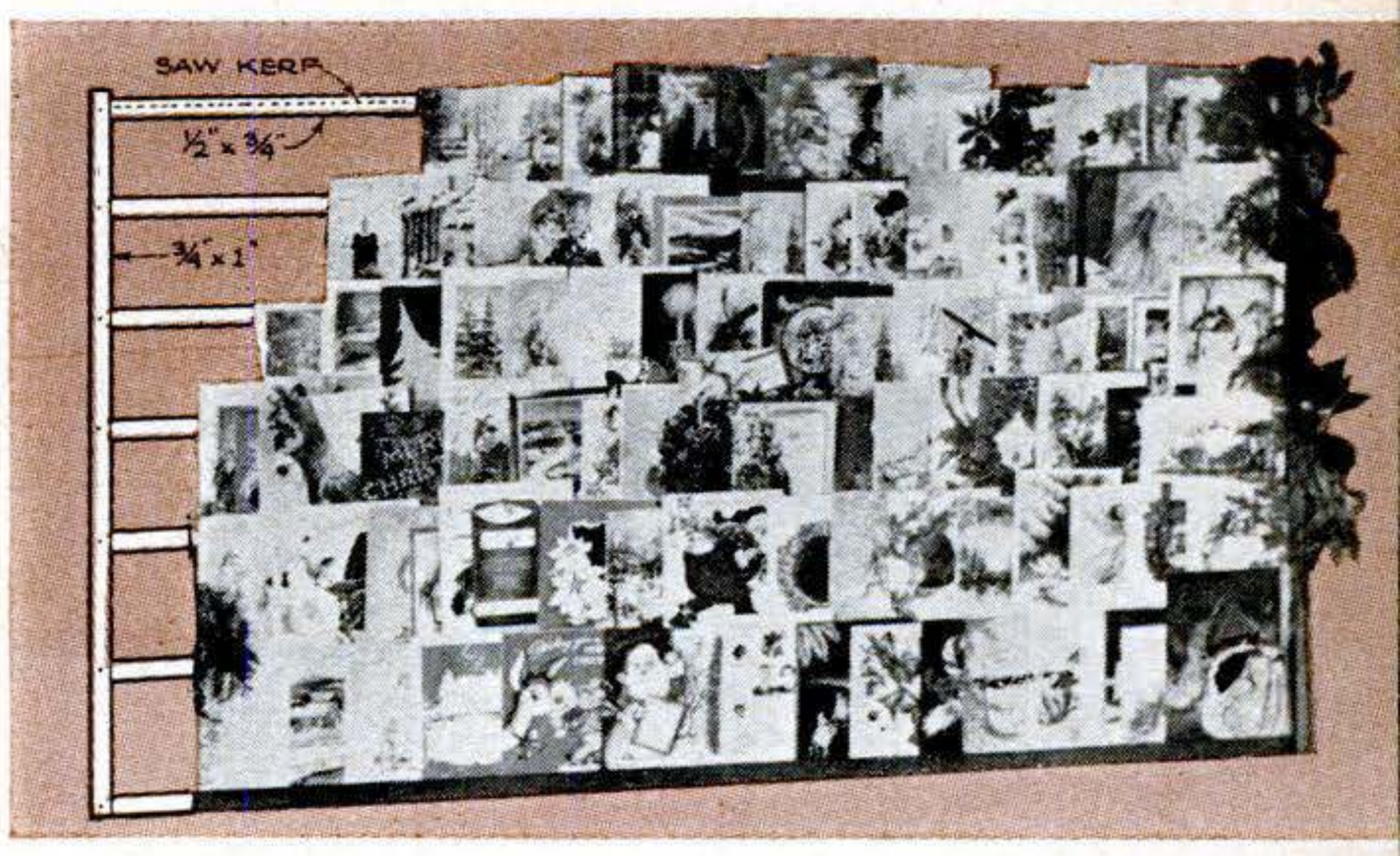
Cement the body to a small square base cut from clear or colored plastic.

Building time: three hours.

Rack Shows Cards. Friendly, bright-colored Christmas cards make a nice holiday decoration, but are generally too flimsy to stay propped up on a mantel or table. This rack, with saw kerfs on the upper sides of the rails, holds the cards well.

Use any scrap lumber that can be ripped into suitable strips. Saw the card-holding kerfs, assemble the frame, and finish to match the table on which it is to stand.

Building time: one hour.



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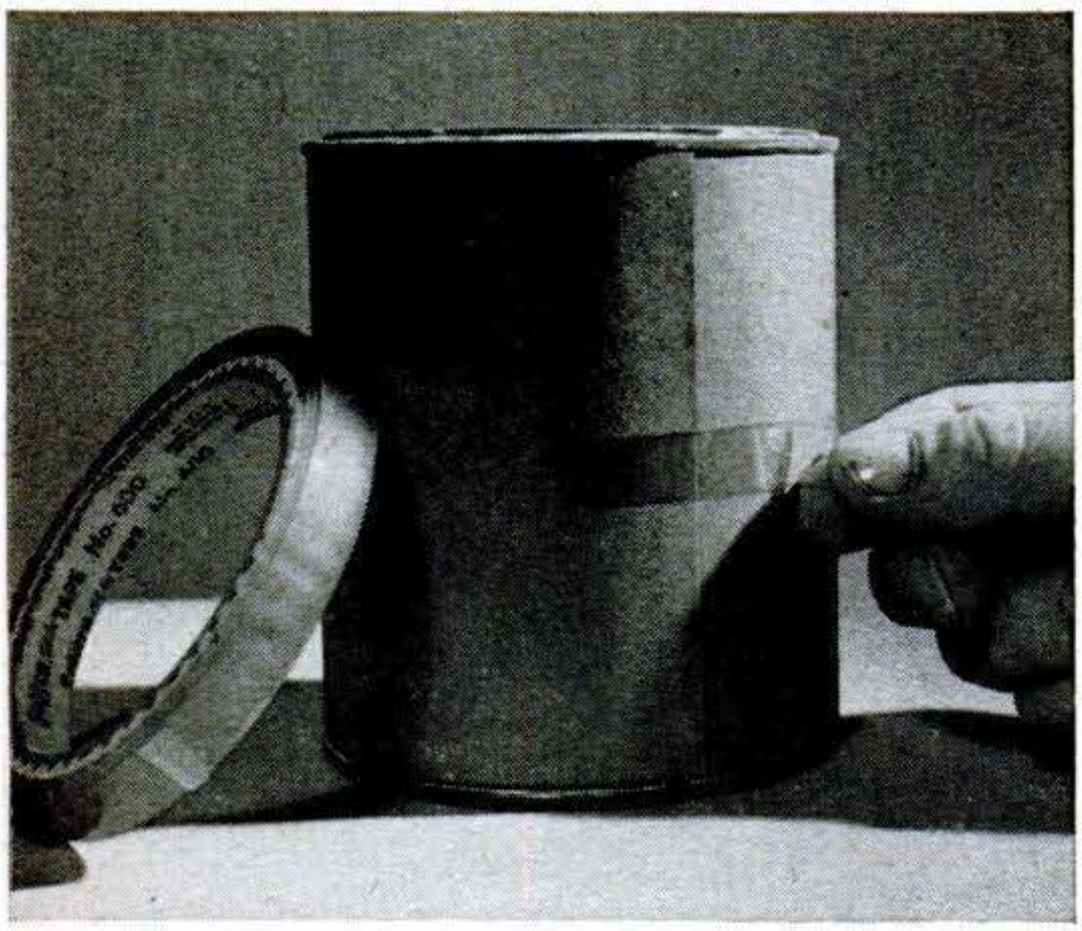
Music Lights Christmas Tree

AN ELECTRONIC color organ controls the lights on the Christmas tree at Cleveland's Case Institute of Technology. When the recorded music that "plays" the lights dips to somber bass tones, blue bulbs light up. As the pitch of the music rises, the blue gives way to yellow, then to red. The brightness of the lights changes with the loudness of the music. It's all operated by an electronic filter system designed by Richard C. Hahn and built by him and other Case students.

Protect Paint-Can Labels

WHEN you intend to use only part of a can of paint, especially if it is a type you're not familiar with, it pays to tape a strip of paper around the label. Paint that runs down the side of the can then won't cover the printing. You will still be able to read the directions any time you want to use up what's left.—*Ken Murray, Colon, Mich.*



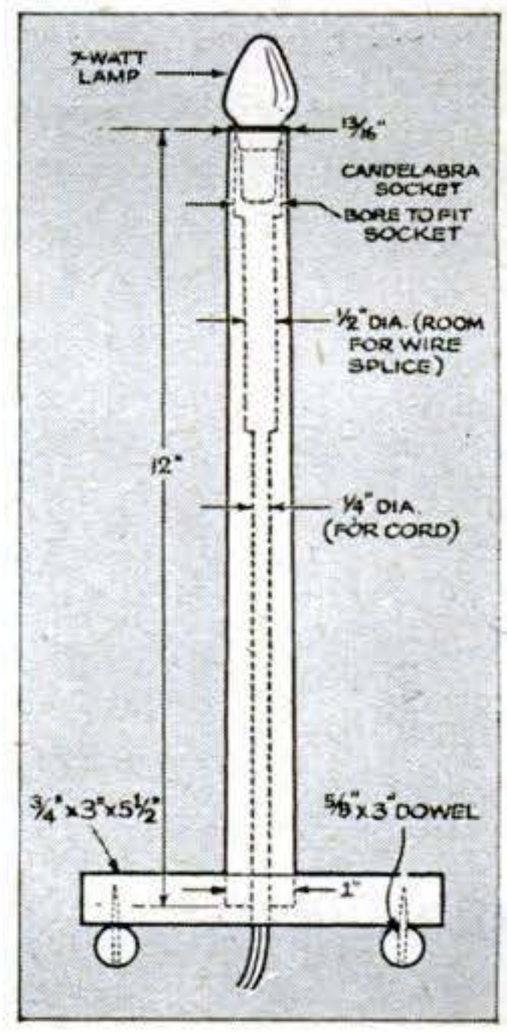
Candles Light Holiday Welcome

ELECTRIC candles in your front windows will add a friendly note during the holidays.

You can make them of 12″ lengths of 1″ dowel. Bore a hole in one end to take a candelabra socket cut out from an old string of multiple (115-volt) lights.

The candle tapers 3/16″ from bottom to top. You can turn it on the lathe, shape it freehand on a sanding disk or belt, or sand it in the drill press. If you use the drill press, extend the dowel through the table hole to prevent whipping and sandpaper as it spins.

Run through the ¼″ hole for the electric cord by boring halfway from both ends. Provide a larger bore at top for the wire splice. Mount on a base, sand smooth, and finish with white enamel. — *Karl Greif, Norwich, N. Y.*



Bell Clears Path for Sled

MOST youngsters yell their way through the crowd sledding on a popular hill. But they may have more fun clearing the way with a bicycle bell attached to the sled. If the steering arm is too wide to take the bell, attach it to the metal side strip of the sled where it will be within easy reach. Wrap the section with tape before attaching the bell.—*R. M. Woodbury, Natick, Mass.*

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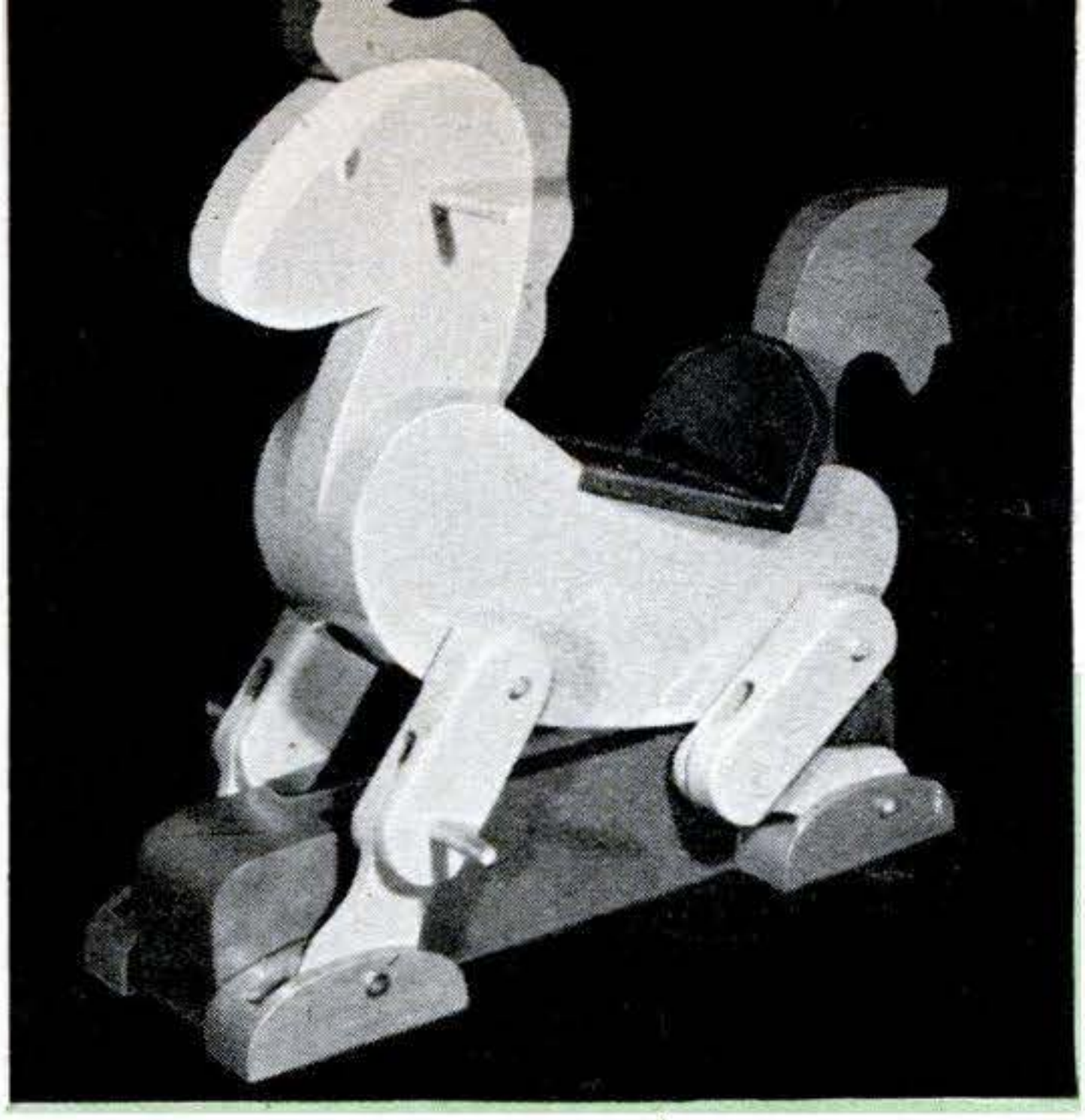
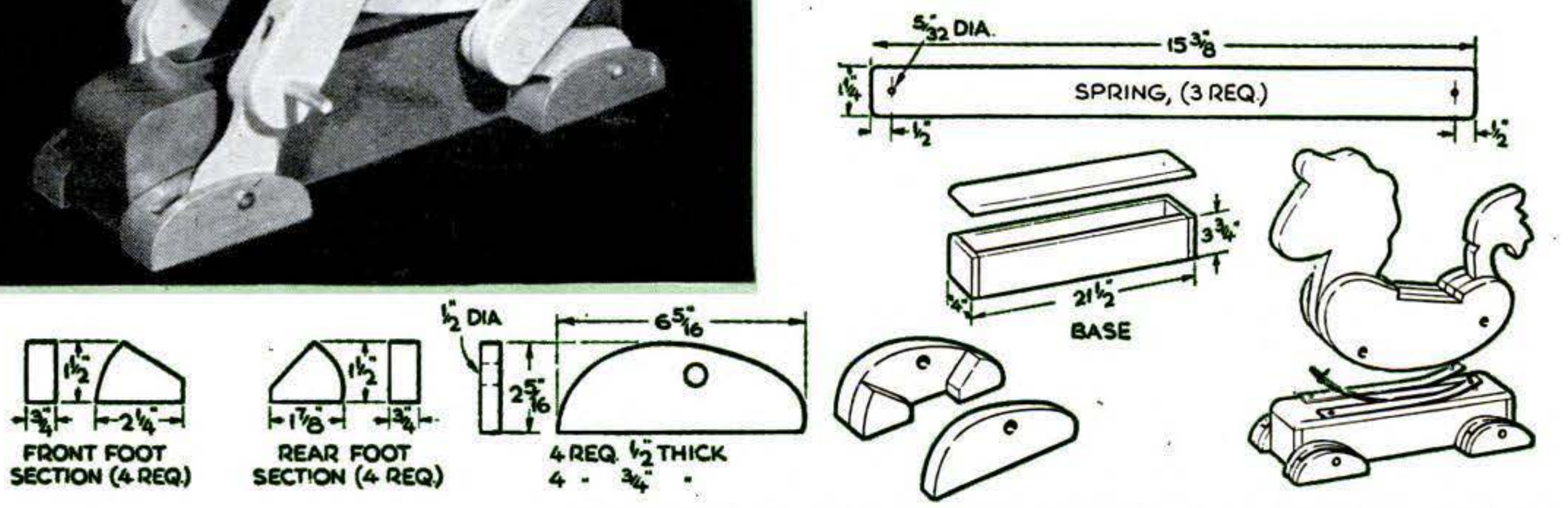
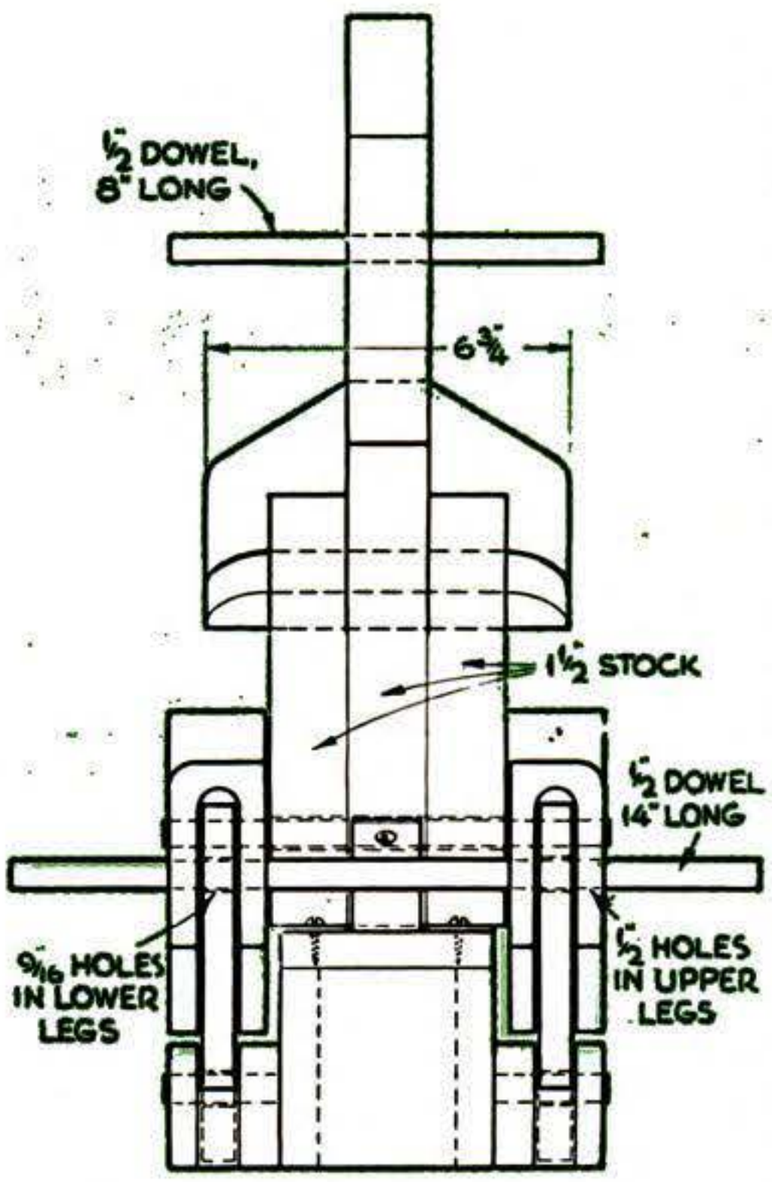
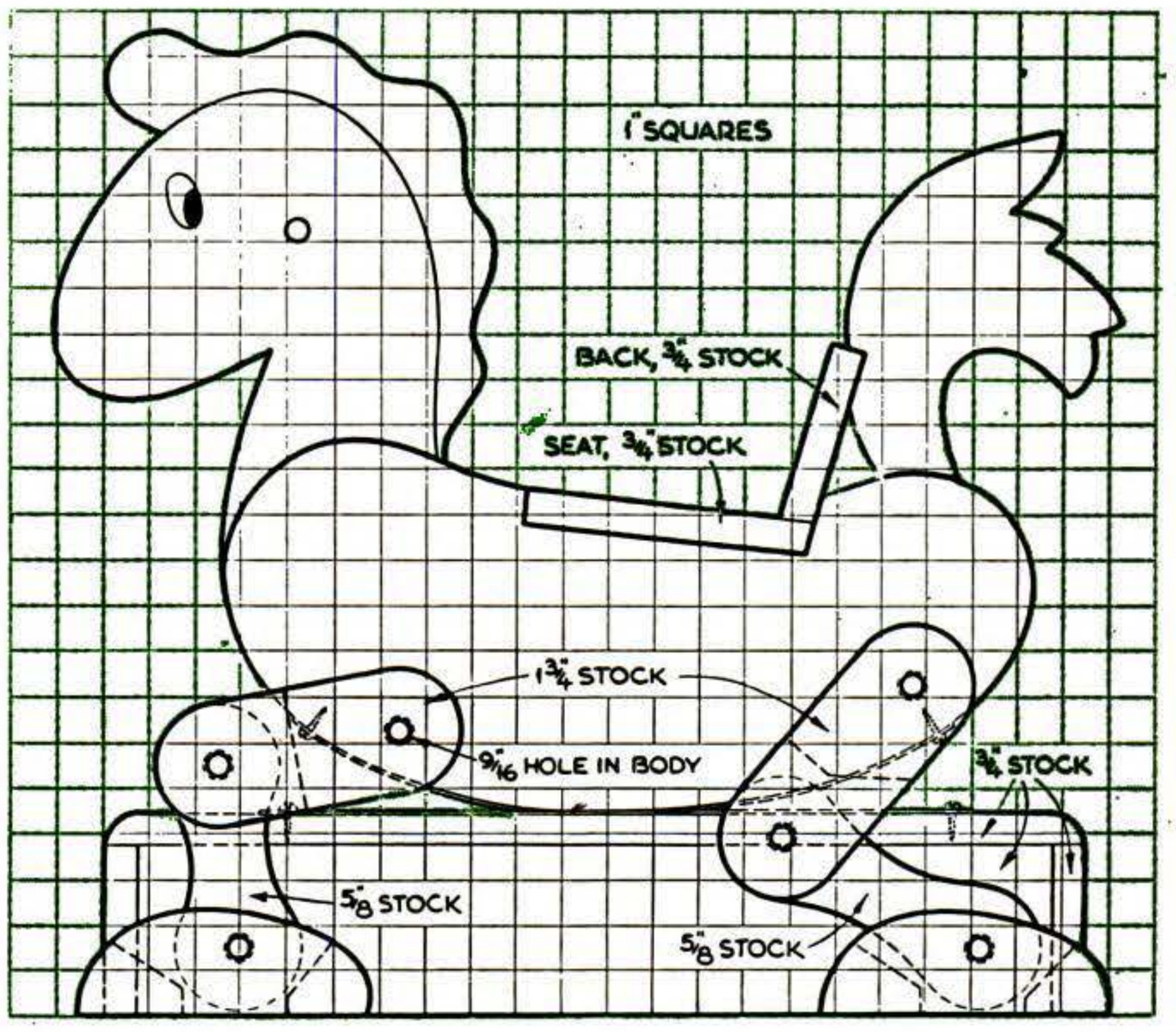


Living-Room Pony for Small Cowboys







This rollicking steed for small fry has a springy gait and full knee action.

WHEN your young Hopalong is galloping wildly through the sagebrush to head off the bandits at Red Gulch, he couldn't ask for a better mount than this.

Begin construction by making a full-size layout on paper or cardboard, taking the profile off the squares, and then transferring the patterns to the stock. I used 1½"-thick white pine for the center and the sides.

The feet are made in pieces and glued together, as shown in the drawing. Note that the feet must be assembled in pairs for the left and right side of the horse. The body overhangs the base, so the inside pieces of the feet must be ¼" thicker than the outside pieces for proper alignment.

Three curved steel strips, fastened at alternate ends, give the pony his gallop. Use .032" spring steel about 1½" wide, and make the screw holes either by punching or by annealing, drilling and rehardening. If you can't find spring steel, use ordinary cold-rolled that is a bit thicker.

Here's a suggested color scheme: body and legs, light tan; mane, tail and feet, brown; forehead, ivory; saddle, red; and base, green.—*R. T. Basnett, Kenmore, N.Y.*

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If Santa Brings Her a Doll . . .

Make this set of plywood furniture and your little girl will be overjoyed on Christmas morning.

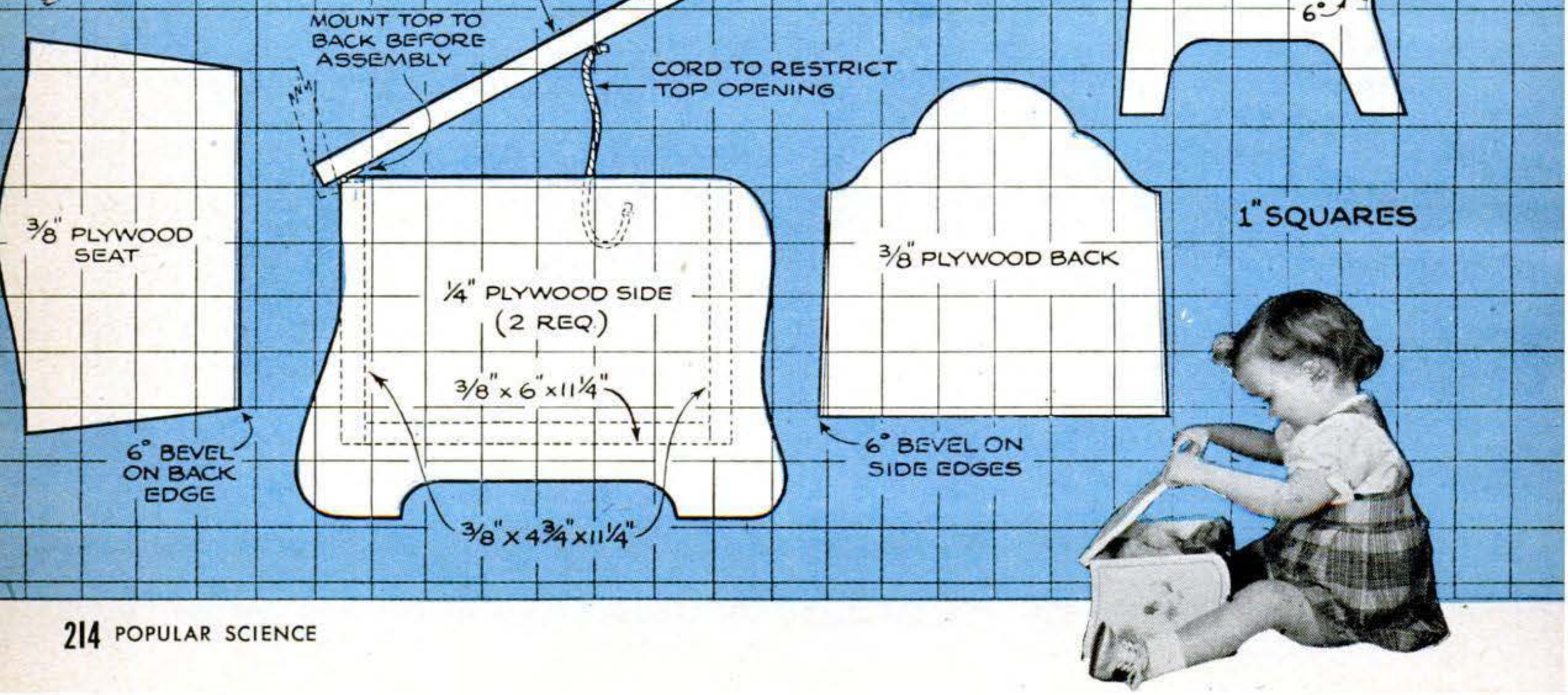
EVERY new baby should have a crib, a chair and a chest for clothes. If doll-furniture prices appall you, make your own the way I made the pieces shown here.

Transfer the layouts to the proper thicknesses of plywood. Tack the stock together and jigsaw matching parts simultaneously. Note that you can cut the cradle head and foot this way, first sawing to the head outline, then separating and finishing the foot.

The cradle head requires a large notch on each side, the foot a smaller one, for the ends of the sides to enter. After the sides have been fastened to the head and foot, bevel the edges of the cradle bottom so it will drop snugly into place.

Assemble the furniture with glue and 1" finishing nails. Fill end grain and nail holes and sand smooth. Apply a coat of primer and follow with a coat of enamel. Decals and freehand striping with a thin brush complete the decorations.

The colors I used made a big hit in our house. The cradle and chair were enameled white and trimmed with a very bright red. The clothes chest was made a light blue with dark blue trim.—*Karl Greif, Binghamton, N. Y.*



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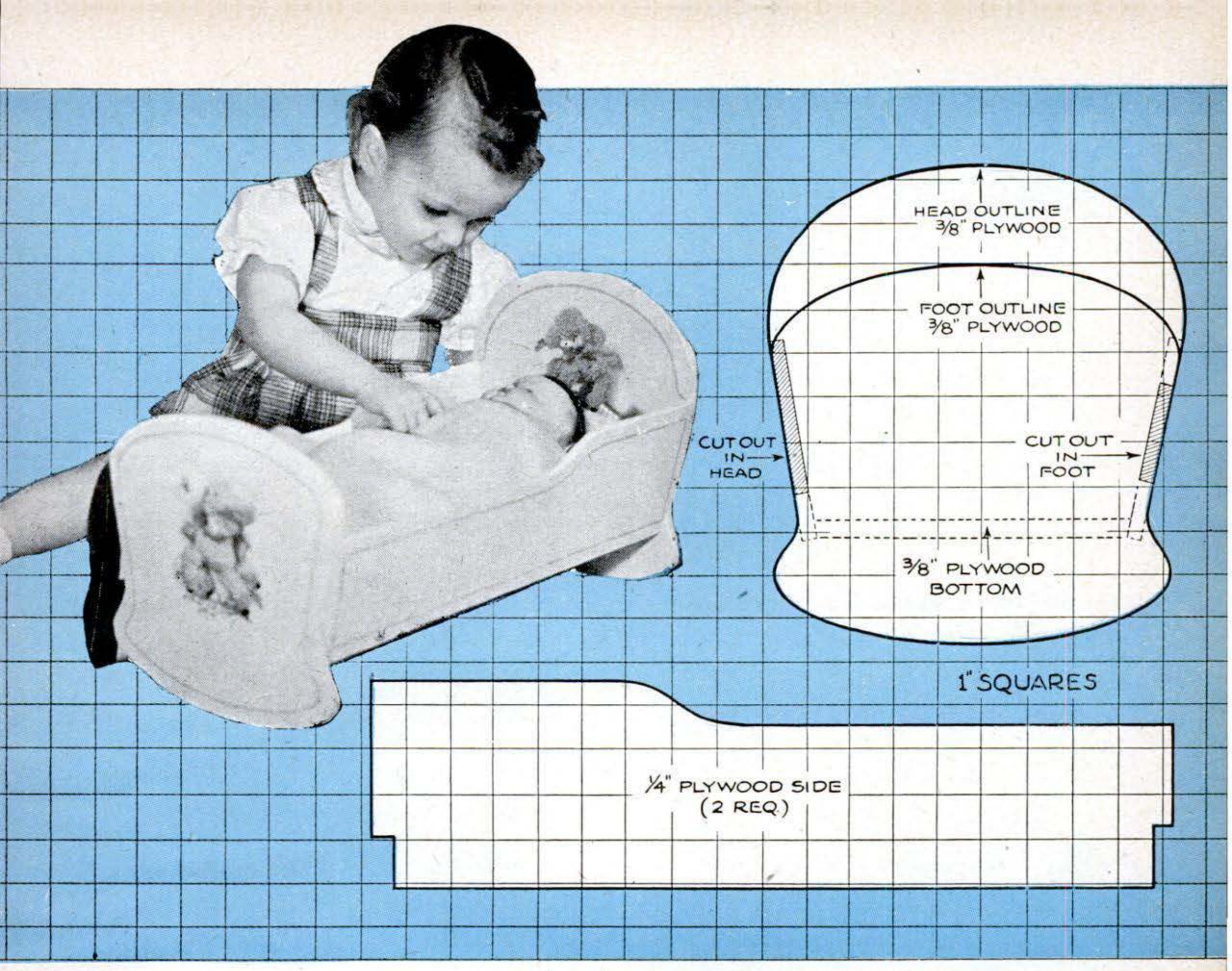
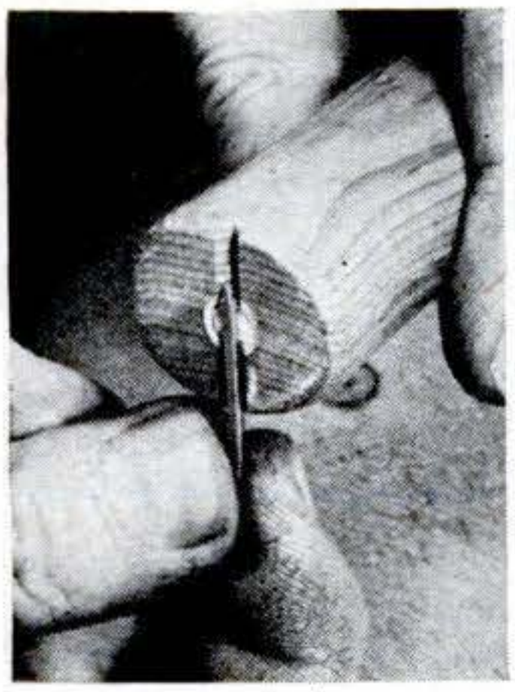


Pads Protect Abrasive Wheels

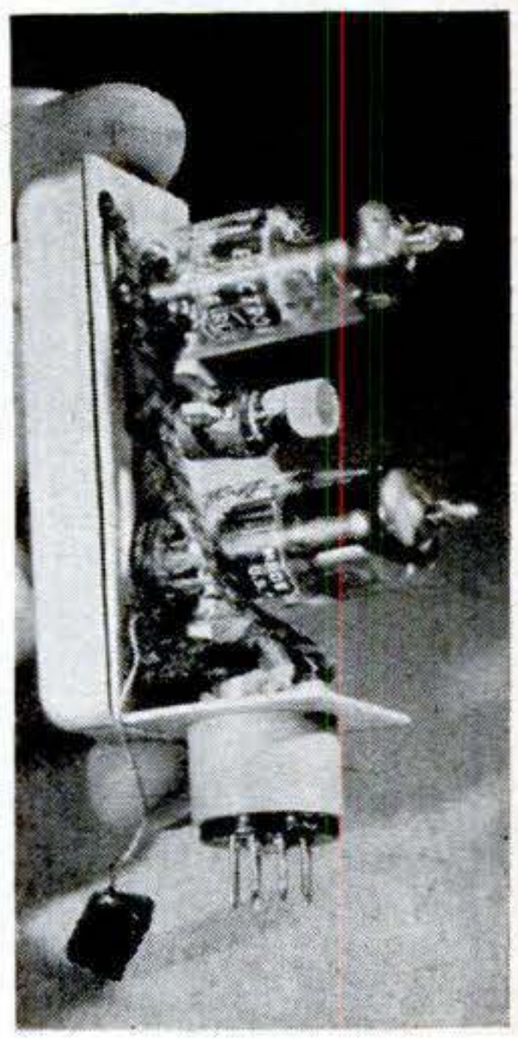
ABRASIVE wheels and cut-off wheels often chip or crack when stored one on top of another without protection. Squares cut from inner tubes and used as separators will pad them.—*George Kapitan, The Bronx, N.Y.*

Well in Hammer Oils Nails

NAILS are easier to drive if slightly lubricated. An oil reservoir built into your hammer is handy for the purpose. Drill a hole in the bottom of the handle and press in a short metal tube. File a groove across the handle and tube and pack the tubing with cotton moistened with machine oil. Before driving a nail, draw it across the groove and it will pick up just the right amount of oil.—*Walter E. Burton, Akron.*



TV Booster Adds Tube to Set



TO USE this booster in a TV set you remove one tube and put back two. The compact chassis holds the tube you take out, a new one just like it and an extra stage of intermediate-frequency amplification. The whole unit plugs right into the original tube socket and a little magnet (shown dangling at the bottom) grounds the booster to the set. The IF transformers in the receiver usually have to be readjusted when the booster is installed. Then the extra circuits become part of the set and require no further tuning or switching. Barb City Industries, De Kalb, Ill., market the booster unit.

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Toy Chest and Shelves

By Bertram Brownold

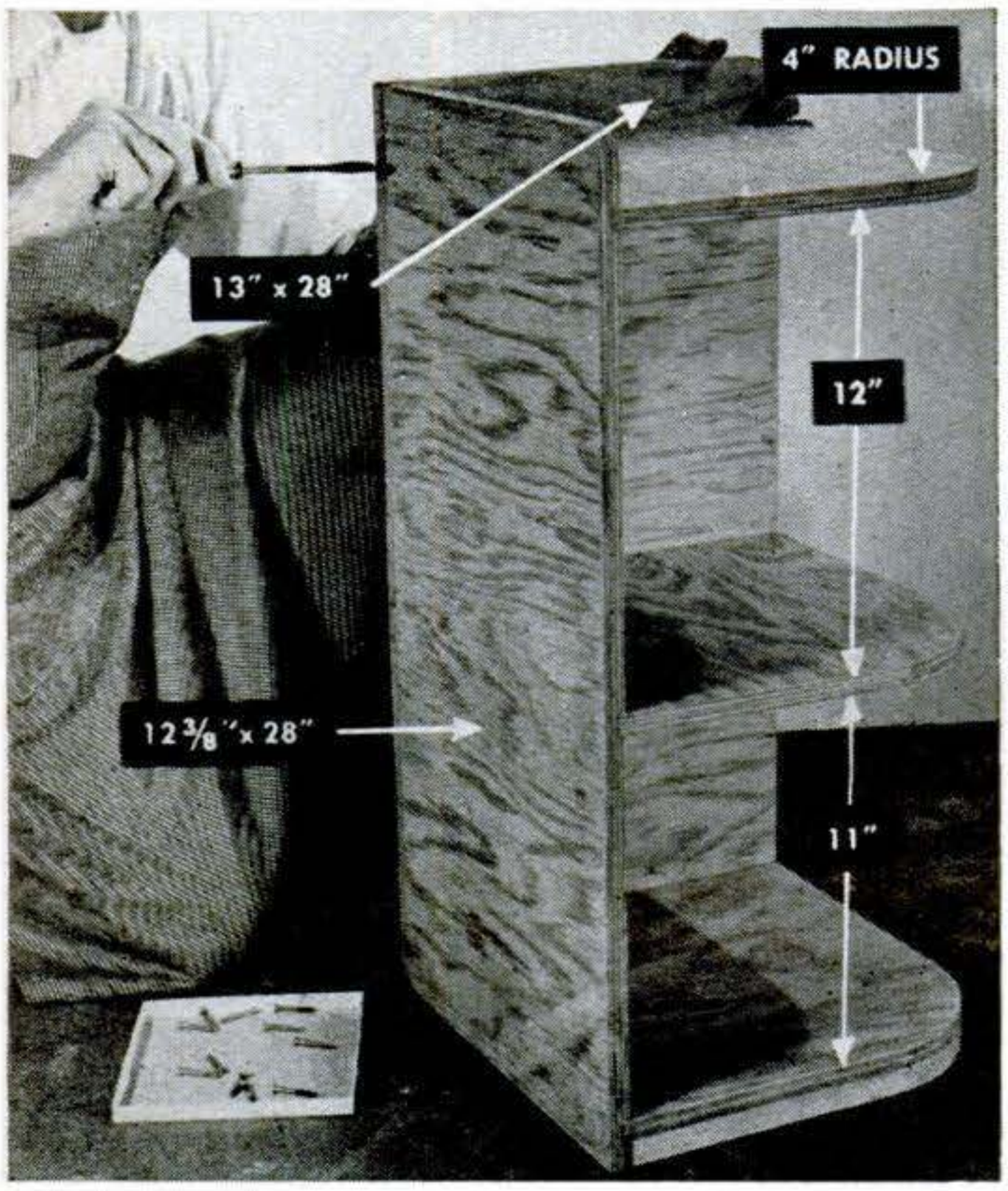
CHRISTMAS comes but once a year, according to the calendar. But from the looks of my house—until the other day—you'd have thought it was once a month.

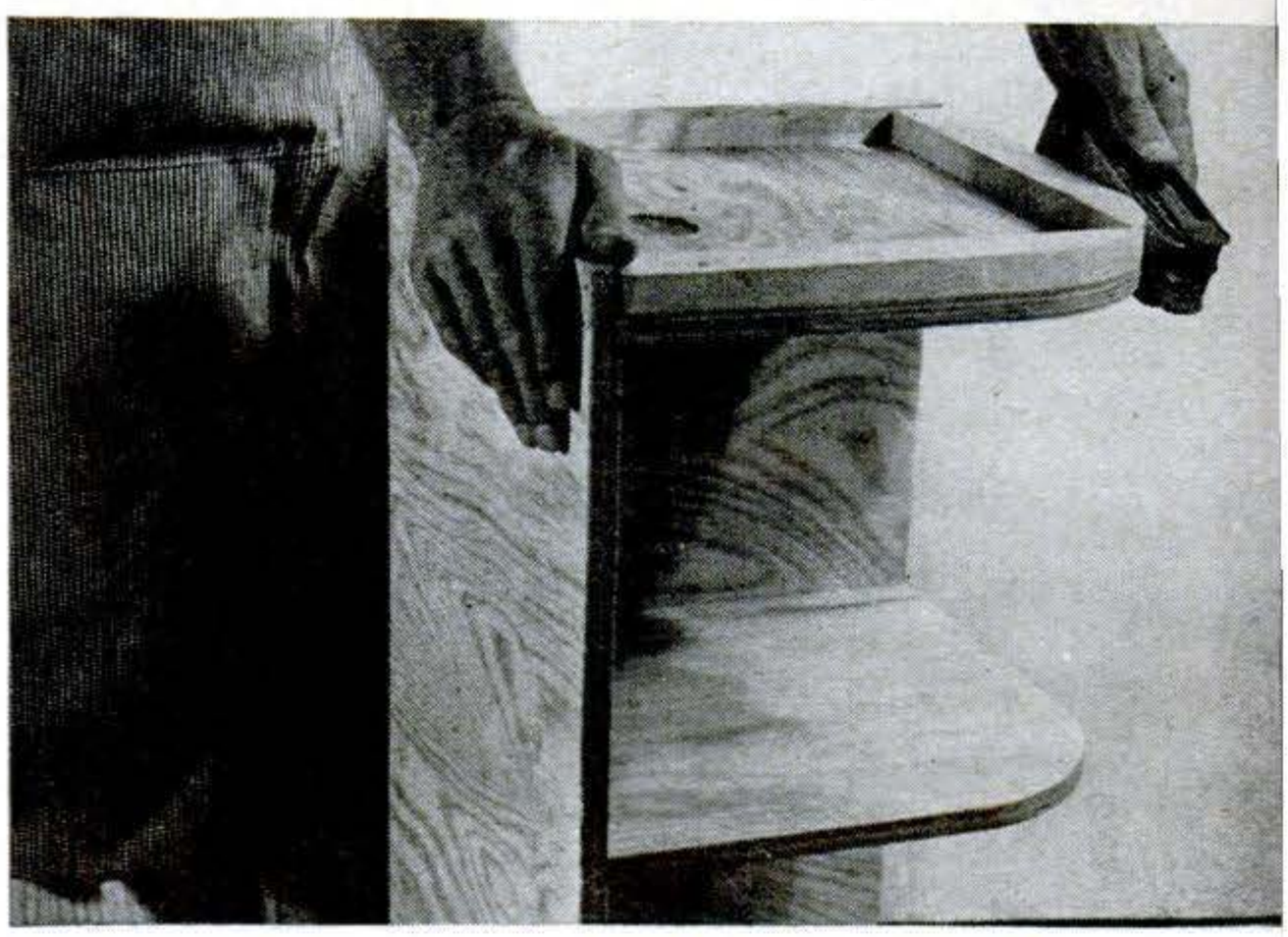
My children, like most kids, accumulate toys and flatly refuse to throw any of them away, no matter how beat up the toys may be. When I walked across a room, I never knew when I'd trip over a model fighter plane and fall flat on my face or step on one of those lifelike dolls and have it rear up and scream at me.

So to organize the toy situation, I built this combination chest, seat and shelves. The chest holds toys and the shelves take a record player as well as other things that aren't normally piled into a chest.

The three units can be used separately, but I have them tied together with mending plates on the back.

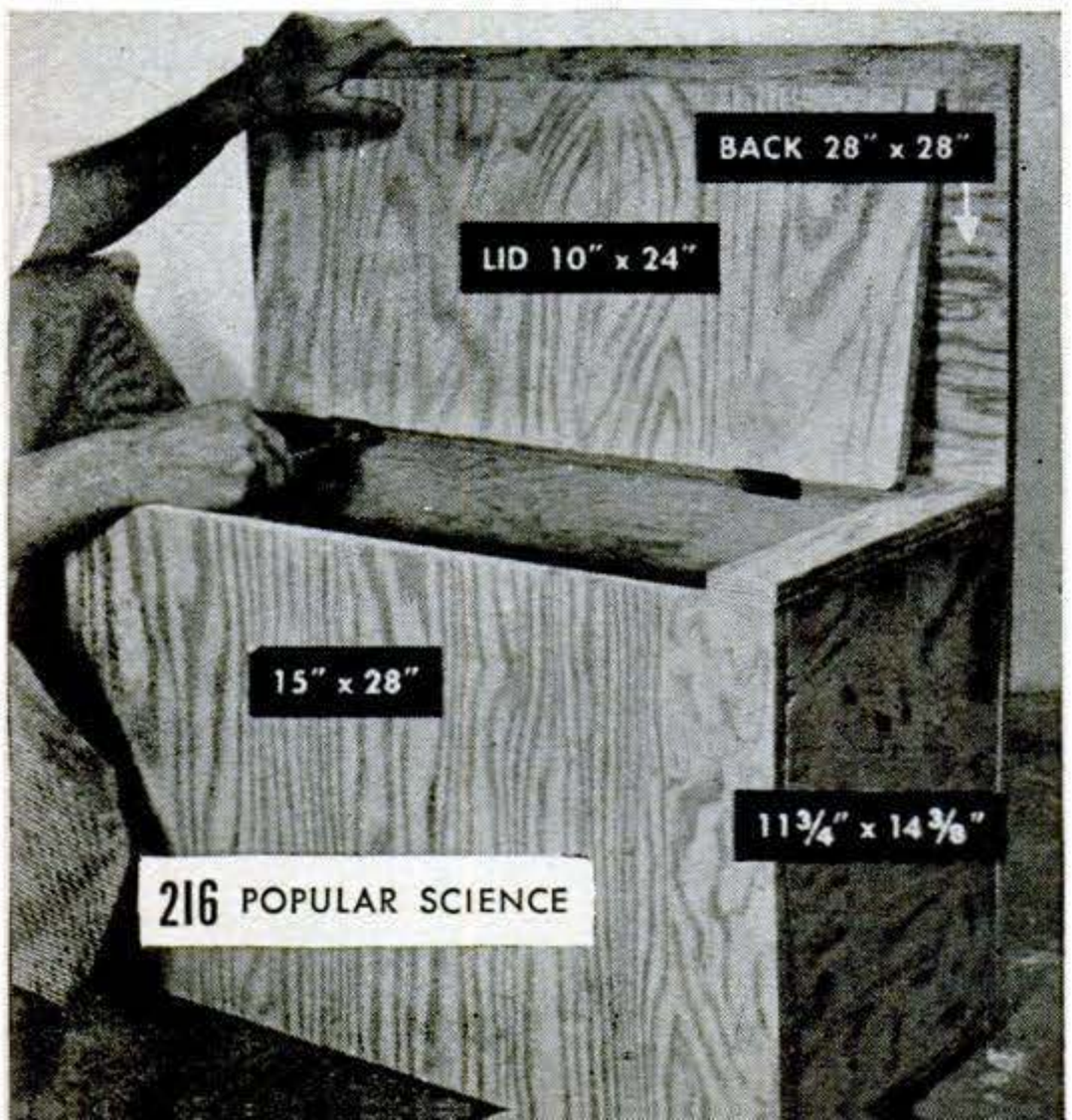
Construction is with simple butt joints, except for dadoes where shelves join upright





TWO PIECES OF WOOD, shaped to follow the curve, are glued to underside of bottom shelves. Sand edges before enameling.

DADOES cut in back and sides take the shelves (left), which are also glued and screwed. Countersink for screw heads, use filler.



CHEST LID IS HINGED to strip of wood that is secured with angle irons inside chest (left). Note that rear corners of lid are rounded.

SECTIONS CAN BE USED SEPARATELY or as single unit. Joined with mending plates (below), they can be easily taken apart for moving.

Tidy Up Child's Room

parts. The dimensions I used are given on the photos. All parts, except the cleats under the bottom shelves, are made of ⅝″ fir plywood. The cleats are scraps of solid stock.

The shelves are glued and screwed into dadoes cut in the vertical members. A coat of enamel undercoater followed by a coat of enamel completed the job. Quilted cover is optional.

PLENTY OF ROOM ON SHELVES AND IN CHEST to store lots of toys out of the way. Chest contains about 4,500 cu. in. of storage space.

Toy Duck Wags Head When It Walks

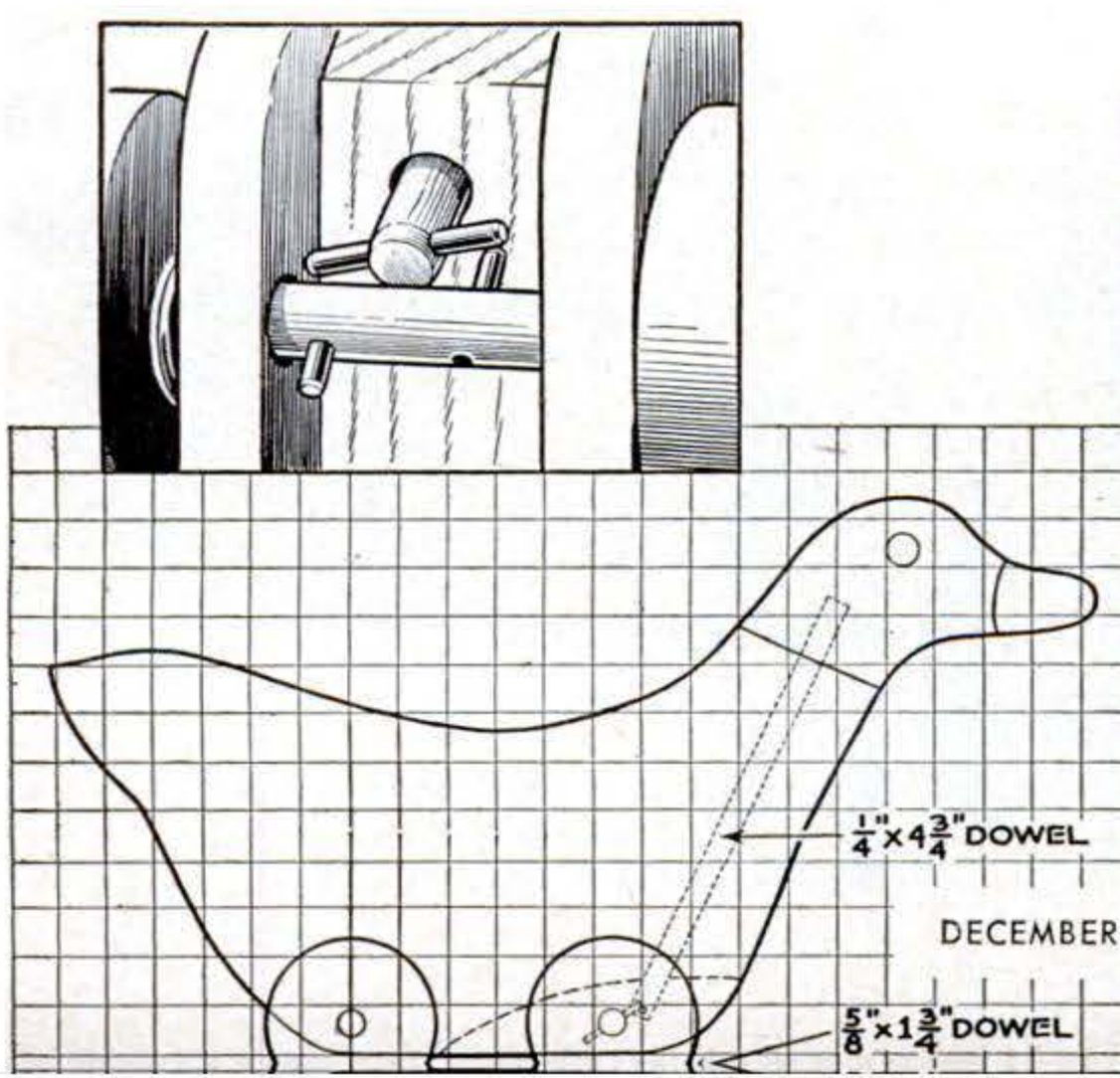
TAKE this duck for a walk and he'll swivel his head happily at every step. It's an ideal mechanical toy for the youngster who has just started to walk. It has no sharp corners, and even if your child has strong take-it-apart instincts, he'll have trouble damaging the simple, rugged mechanism.

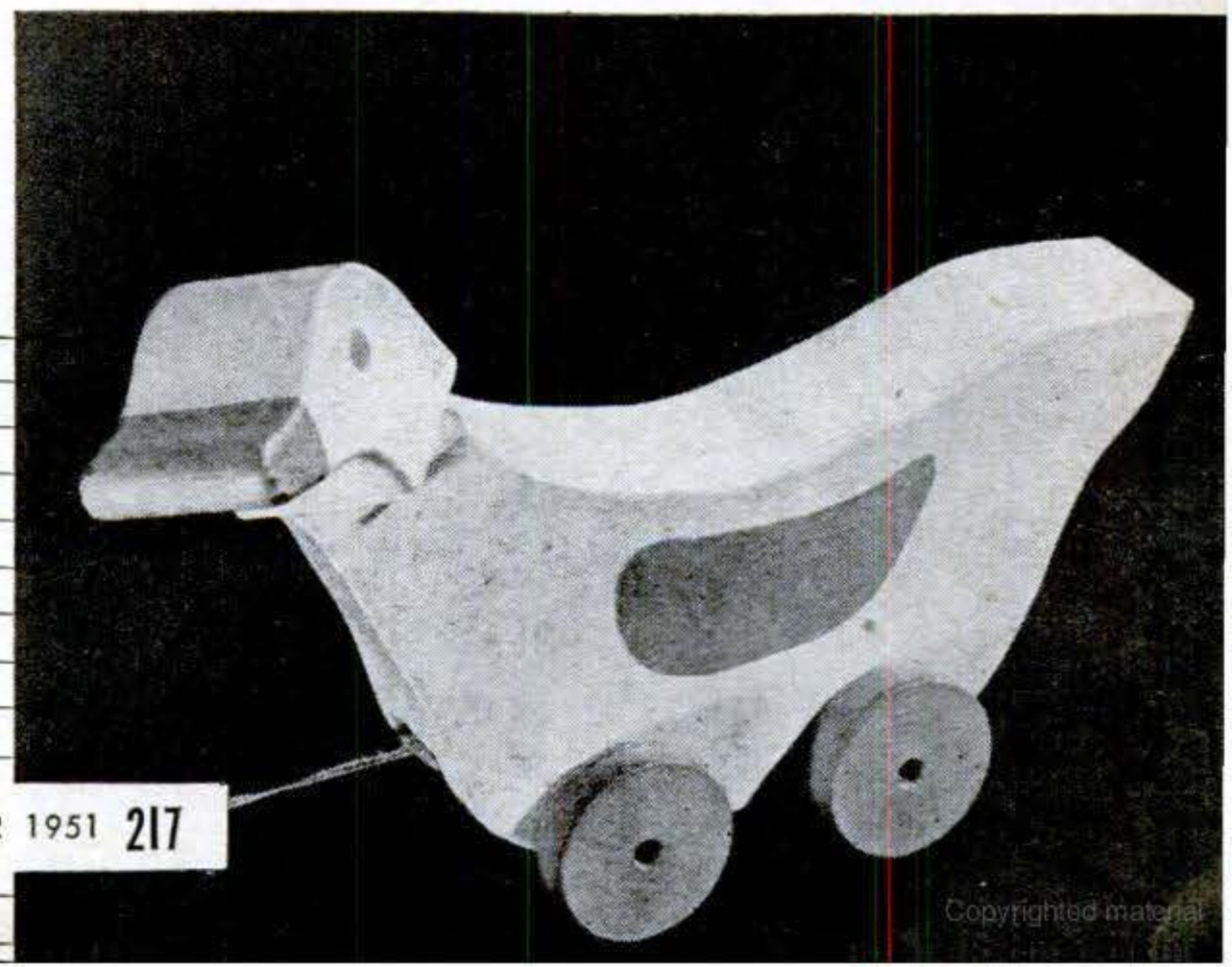
Enlarge the squared pattern and rough out the body of the duck from a piece of soft wood about 1⅝″ thick. Cut a slot in the bottom 1″ wide and ¾″ deep to take the mechanism.

Lay out the angle of the shaft that runs from the body up into the head and carefully drill a pilot hole less than ¼″ in diameter, stopping the hole short of the top of the head. Cut off the head on a line perpendicular to the shaft hole. Re-drill the head for a press fit on the ¼″ dowel shaft and re-drill the body to 17/64″.

To make the wheels, cut ⅝″ slices off a 1¾″ dowel or small rolling pin. Drill them to fit tightly on the ¼″ dowel axles, with metal washers to reduce friction.

Make three steel pins from wire nails and file off all sharp points. Force-fit them in undersize holes in the shaft and front axle as shown at left below.—*William Zack, Berwyn, Ill.*





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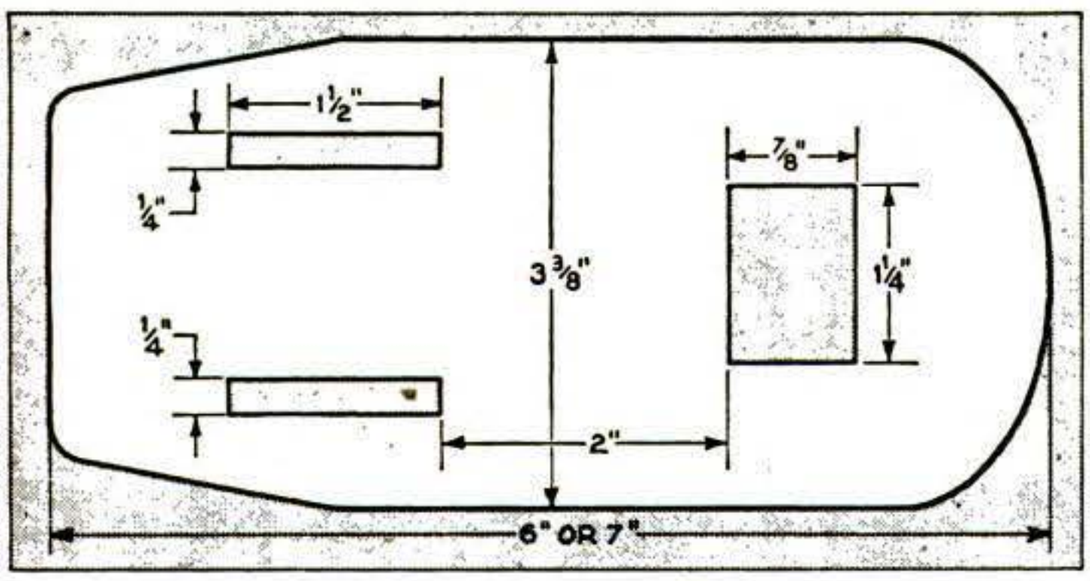
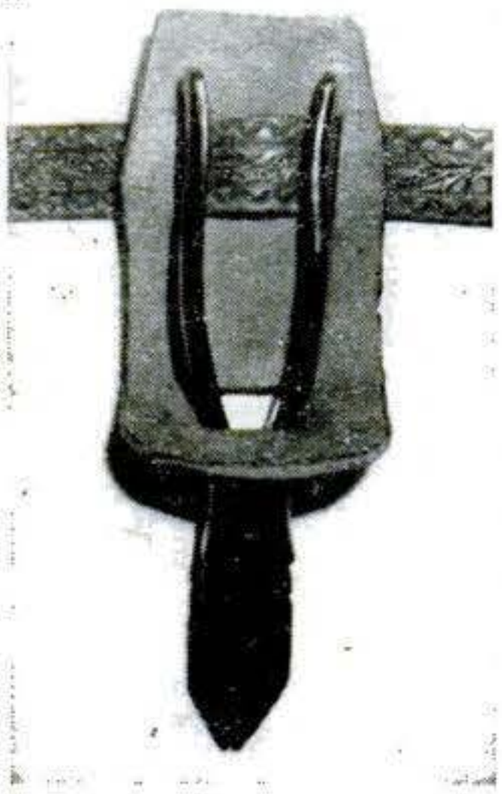
Pin-Up Board Holds Toys

COVER a playroom wall with perforated hardboard and it becomes a huge pin-up board for light toys. Golf tees serve as pegs. The photo above shows its use in a playroom designed by Joseph Aronson for the American Toy Institute in New York.

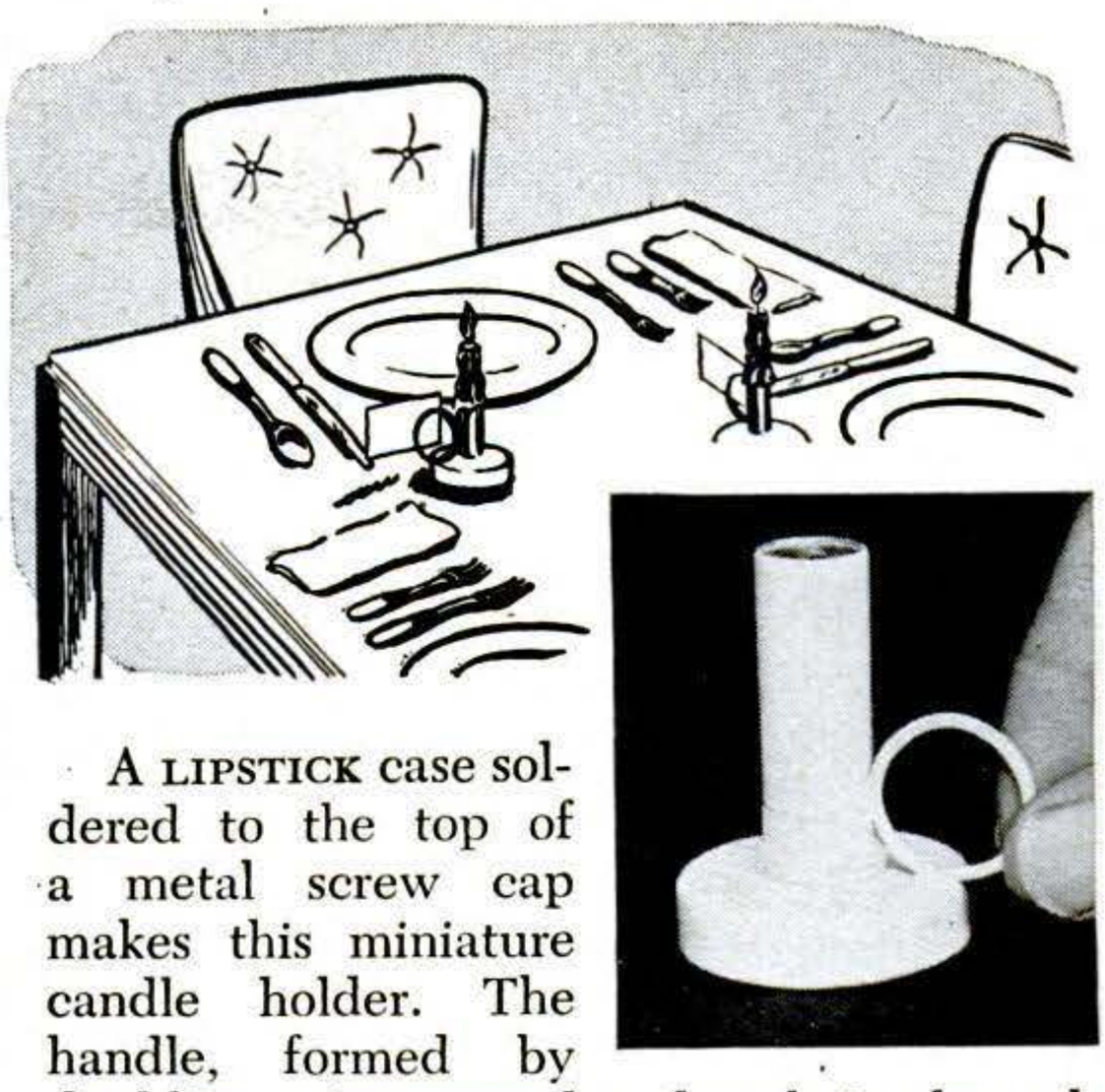
Tool Sheath Saves Pockets



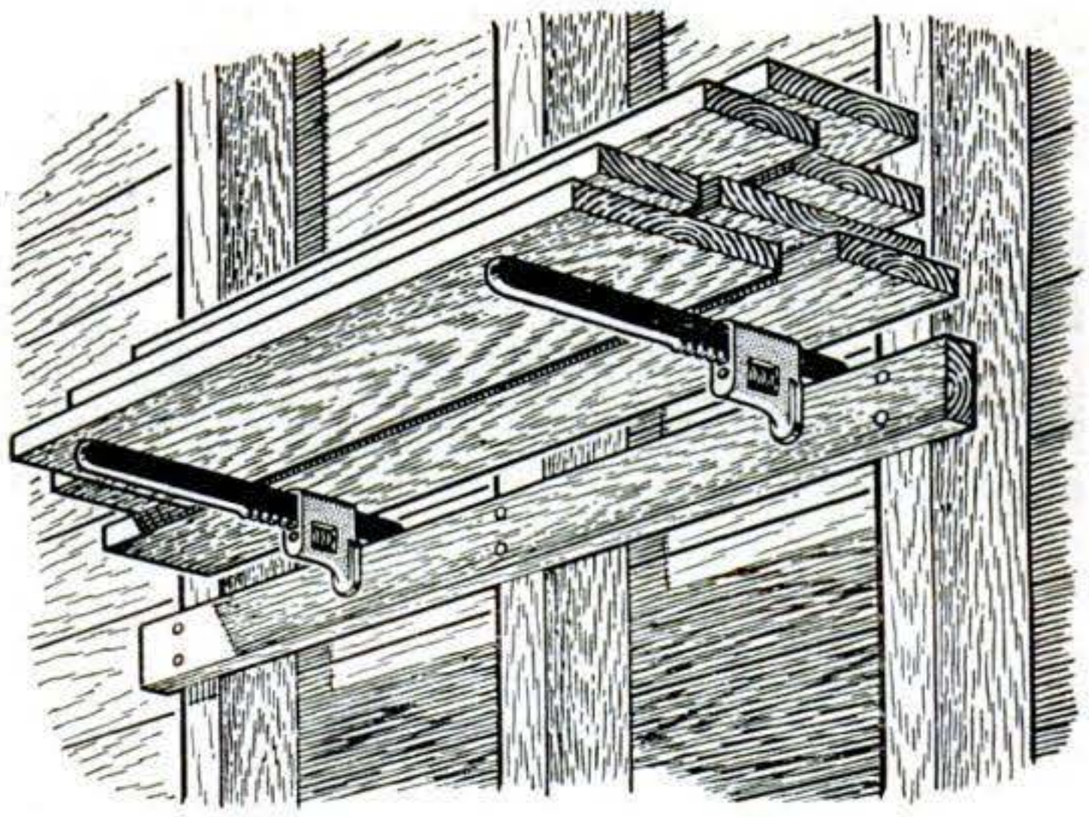


THIS belt sheath for linemen's wire-cutting pliers may be cut in a few moments from sole leather. The dimensions given above make a holder for 8" or 9" pliers. Wet the leather before cutting it. Curl up the tip while the leather is still wet and let it dry in that shape.—*C. Wilson, San Antonio.*

Tiny Candlesticks Dress Table



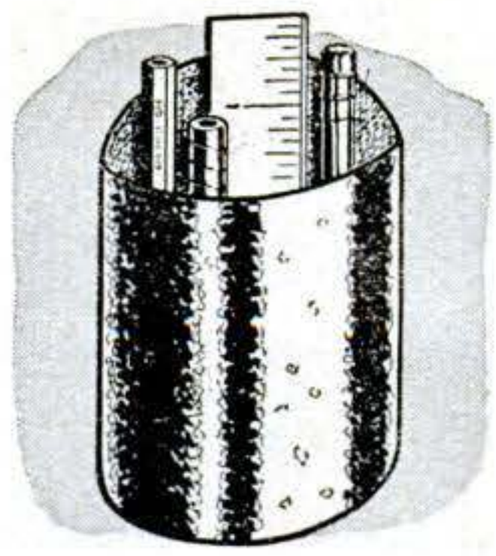
A LIPSTICK case soldered to the top of a metal screw cap makes this miniature candle holder. The handle, formed by doubling wire around a dowel, is also soldered in place. The double ring holds a place card firmly.—*John J. Rea, Urbana, Ill*



Wrench Makes Shelf Bracket

WHEN you can't find a shelf bracket around the shop and need a temporary support for lumber or pipe, try a monkey wrench. Clamp it on a cleat and use the handle as a support. A length of 1" water pipe over the handle will extend it if necessary.—*Victor H. Lamoy, Upper Jay, N. Y.*

Glasses Case Holds Pencils



IF YOU carry pens and pencils or small tools in your coat pocket, you can make a sturdy pocket liner by cutting down an old leather eyeglass case.—*George Kapitan, The Bronx, N. Y.*

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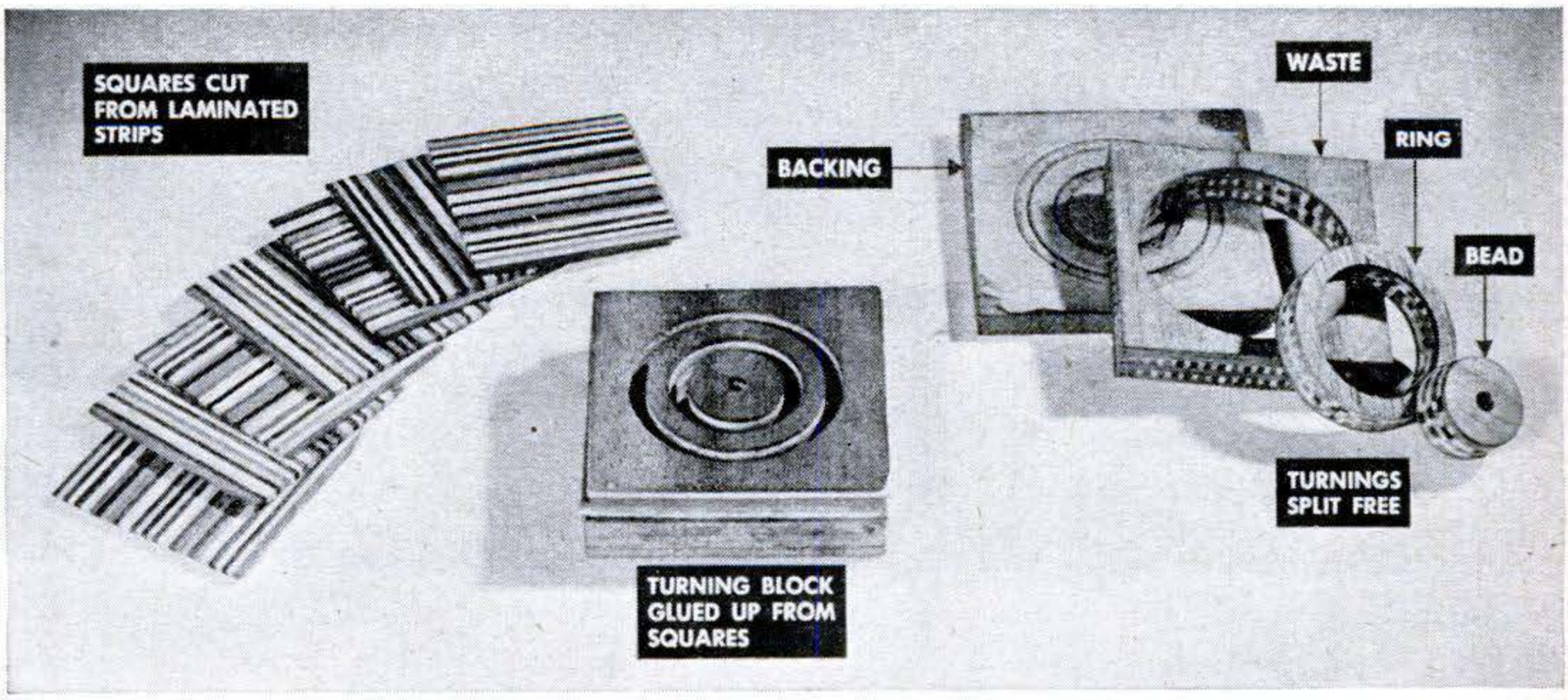
Gay Wooden Jewelry Is Fun to Make

These Christmas gifts, turned out on a lathe, sparkle with hundreds of bits of gleaming color.

IF YOU think wood turning has no more surprises for you, try this on your lathe. Watching these colorful laminated rings come to shape is good fun. As a dividend, you get equally eye-catching beads, suitable for making necklaces and bracelets.

The material is colored wood, sold in sheets 1/28″ thick by veneer dealers. Alternating the colors to suit your fancy, glue up a stack 1¼″ thick with a nonstaining glue such as white casein glue. Clamp evenly, with pads under the clamps.

Leave clamped at least three days. Rip the 1/20″ strips (step 2 in the drawing)



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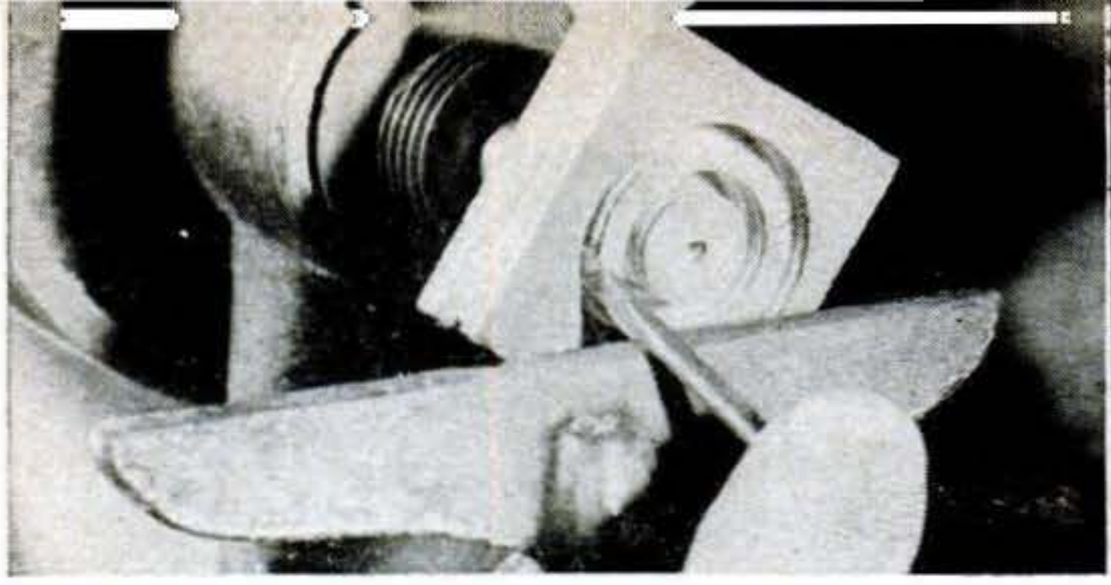
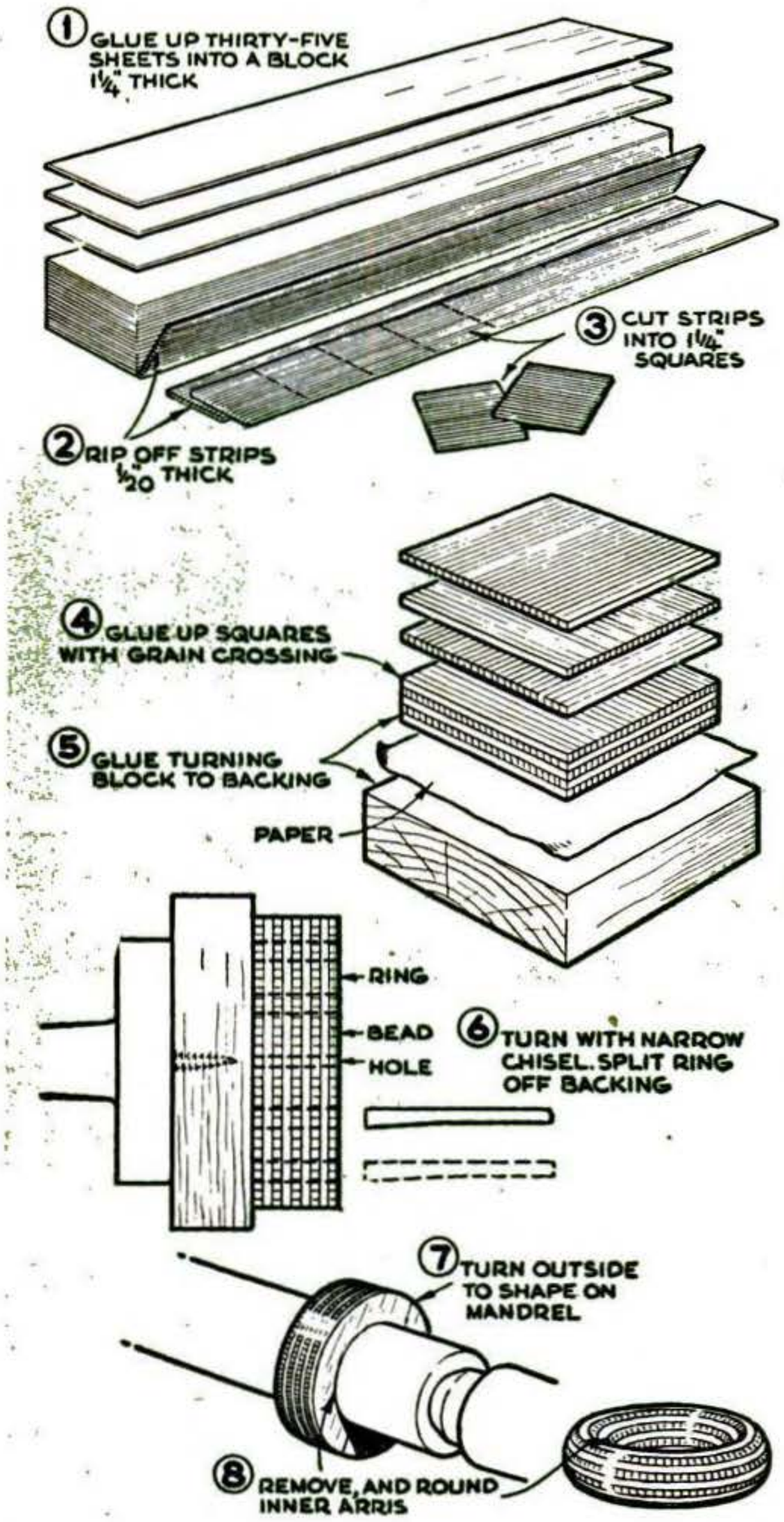


WITH GLUED-UP BLOCK on screw center of the lathe, turn two grooves. The diameter of the inner one determines ring size. Measure a ring that fits the wearer to get size right.

PUSH RINGS onto a tapered wooden mandrel to turn the outside contour. Sand with very fine paper. Several rings of slightly different sizes can be mounted at one time.



right after unclamping, or the outer joints may open because they dry faster than the inside of the block. Crosscut the strips into 1¼" squares.

Then glue up as many squares as necessary to make a turning block the thickness of the ring desired. For strength—and decorative effect—turn each square crosswise or diagonal to the last. Glue the assembled pad to a backing block, with paper between.

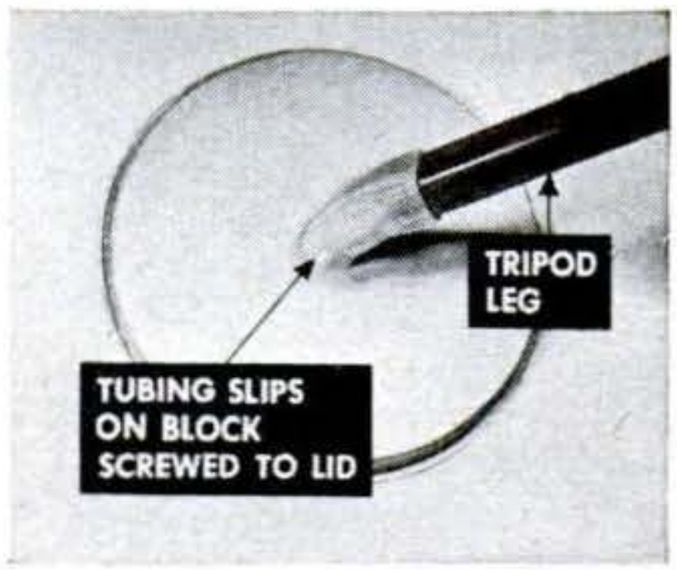
Center-drill the backing to mount the piece on the screw center of the lathe. With a narrow turning chisel (you can grind one from a small file, or even a cut nail) turn two deep grooves right into the backing. Their spacing governs the size of the ring. The center waste makes a bead.

Remove from the lathe, insert a knife at the paper line, and split off the turnings. Smooth the inside of the ring on a small drum sander or with sandpaper wrapped around a dowel. Then mount a larger dowel in the lathe and turn or sand a taper on it so that the ring can be driven on until it grips tightly. Be careful not to break it in doing so. With a sharp tool, round the corners and turn the outside to shape. Finally, sand the sharp arrises inside to prevent chafing on the finger. Finish with clear lacquer and wax.

A simpler but attractive effect is achieved by laying up colored sheets, with the grain alternating, into a pad 5/16" thick. Cut turning squares from this.—*J. A. Hill, South Sioux City, Nebr.*

Snowshoes on Tripod Improve Winter Photos

A SET of snowshoes on the legs of your tripod will keep the camera steady while you are shooting snow pictures. Make them from one-pound coffee- or tobacco-can covers. Punch a hole through the center of each cover and screw fast a wood block. Slip a piece of flexible tubing over the block and the end of the leg. These supports are also handy in setting up a tripod on sand or where the ground is soft.—*John M. Avery, Dexter, N. Y.*



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Let's Talk About

Drills and Drilling

You can't make things without first making holes. The holes come easier when you know a few machinist's tricks.

By Harry Walton

"THERE'S the junk," announced Larry, setting a box down on Jim's workshop floor. "Pieces for Bud's bike carrier and Ann's porch table."

"Hmm—pretty fancy scrollwork."

"Got to make two holes for each bolt and rivet," said Larry gloomily. "I brought my own drills, as you told me to."

"Fine. The drill press is all yours," said Jim. "Go to it."

Larry found two matching pieces of strap iron and put one on the drill-press table. As Jim punched tobacco into his pipe, Larry chucked one of the drills he had brought.

Steel bit into iron. A look of painfully intense effort came over his face as he dragged down on the feed lever. Jim took his pipe from his mouth. "Say, Larry—"

With almost visible relief, Larry shut off the drill press and looked up.

"You said you'd had a lot of trouble drilling. Mind if I try to tell why?"

"Sure wouldn't. My guess is they left the slag in this when they rolled it."

"Let's see another piece."

This Time It's Drilled

While Larry bent over the heap of parts, Jim removed the drill and chucked another. He clamped the work and switched power on. The drill sank steadily into a puddle of chips and cutting fluid fed from an oil can. In a few seconds it was through.

"Do that again!" murmured Larry.

"Oh, no," Jim protested, lighting his pipe. "You do the next, but this time clamp it. At the plant we've got a rule: always hold work with a clamp, a hold-down, or a vise —never by hand."

Larry took the C clamp offered him, and anchored the strip to the table. "Okay?"

"Well, so-so," answered Jim. "This is better." He swung the work around until it touched the left side of the drill-press column. "See how the column bucks the torque of the drill this way?"

Larry nodded, and this time he pushed the drill through fast and cleanly.

"Whatever did you do?" he asked.

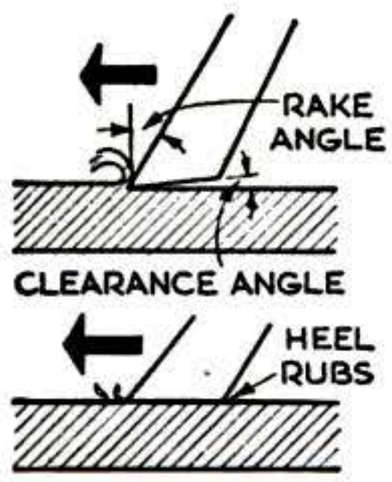
"Pulled a switch," confessed Jim. "That's one of my high-speed drills."

Larry's face fell. "No wonder."

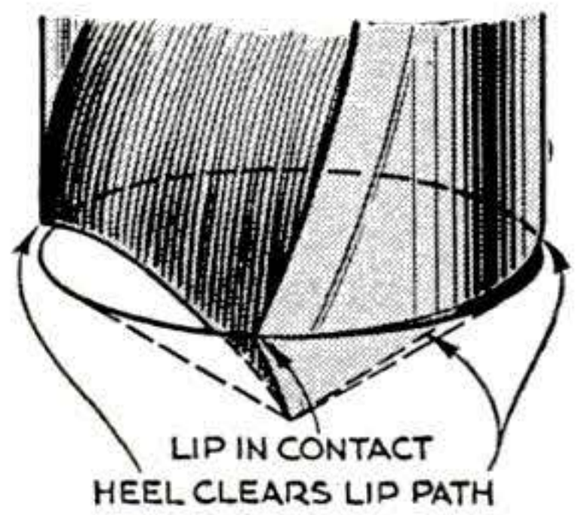
"Now hold it—a carbon drill will do almost as well, if it's in good shape."

"But I ground mine just before I came over," Larry protested. "The cutting edges were as sharp as new."

"Probably, but they couldn't cut. Look—here's how a tool cuts metal." Jim made a



HOW TOOLS CUT METAL



ACTION OF A DRILL

rough sketch. "This rake angle gets under the skin, but the heel has to stand clear of the surface to let the edge dig in. If it didn't—" He made a second sketch.

"The edge would be stymied," said Larry.

"Right. Now imagine this is half of a twist drill. The cutting edge is called the lip. The surface between it and the heel is conical, so that clearance angle is a bit tricky to see. But look at your drill, and the one from the chuck."

Larry did so. "They're alike, except for that line where the point meets the body. It slants on yours. I always grind it straight."

"Uh-huh. And that's your trouble."

No Relief in Sight

Larry stared, then burst out laughing. "I'll be a monkey-wrench's uncle! I must have ground half my drills like that."

"Let's put some relief on this one," said Jim. "Then you try it again."

He switched on the light over his grinder and donned a pair of goggles.

"Nine times out of ten you don't need goggles," he said. "But which is the tenth? And why bet your eyes at any odds?"

He touched the whirring wheel with a chunk of black stuff.

"Carborundum dresser," he explained. "Wheels get out of round in use. A touch brings them back. This is a 60-grit medium-hard aluminum oxide wheel."

Almost casually, he touched the drill to the wheel. Four times sparks flew. Turning the drill, he again touched it four times.

"It didn't need much. Try it now."

Rather dubiously, Larry chucked it and turned on the press.

"Works fine," he reported. "You know, my drills seemed to get dull pretty fast."

"Don't you have an electric drill?"

"Sure. Couldn't do without it."

"Often they're hard on carbon drills. For instance, a ¼″ high-speed drill can be run at over 1,000 r.p.m. in mild steel, but a carbon drill should turn less than half that. Your electric drill, running around 1,500 r.p.m., overheats and dulls a ¼″ carbon drill if you forget to baby it. That's why high-speed drills are recommended for power drilling. You can push them hard, even if you don't use a coolant. With carbon drills you ought to take it easy, use cutting oil, and sharpen them when they get dull."

With a Twist of the Wrist

Larry shook his head. "I'll have to buy new ones. I can't grind those angles."

"Take a try," Jim suggested, walking over to the grinder.

"Don't you use the tool rest?"

"No, but you can. I'll show you a simple jig for grinding drills on it. I use a freehand method an expert showed me."

Picking up a ⅜″ drill between the thumb and forefinger of both hands, Jim laid his right wrist on a block of wood.

"That's my rest. I hold the drill to touch this 7″ wheel about 1″ under the arbor axis. The left forearm rests on the bench, leaving the left wrist free to twist. Sight the 59° lip angle against the wheel to get the proper grinding position. Roll your left wrist to bring the heel into contact first. Then roll it back counterclockwise, grinding from heel to cutting lip."

He repeated the movement.

"Get it? The drill isn't turned in the fingers. The right hand simply follows the left wrist. You get the relief angle almost automatically. Try it."

Hesitantly Larry took Jim's place, put on the goggles, and ground one side.

"Now turn it halfway," said Jim. "It's okay to finish with a touch from lip to heel to take any burr off the lip."

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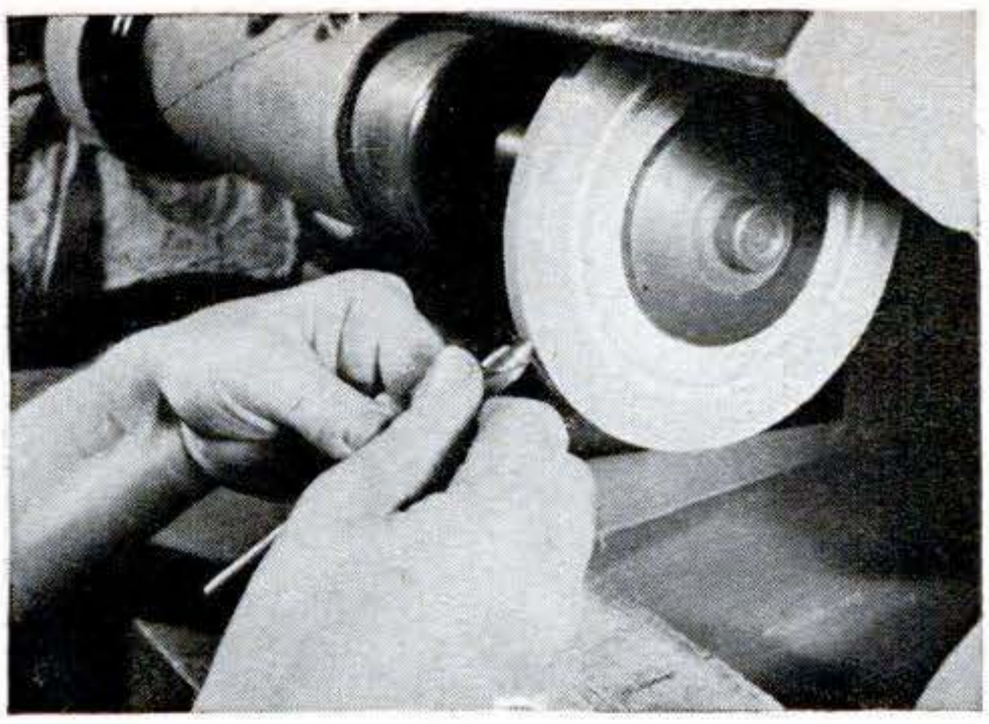
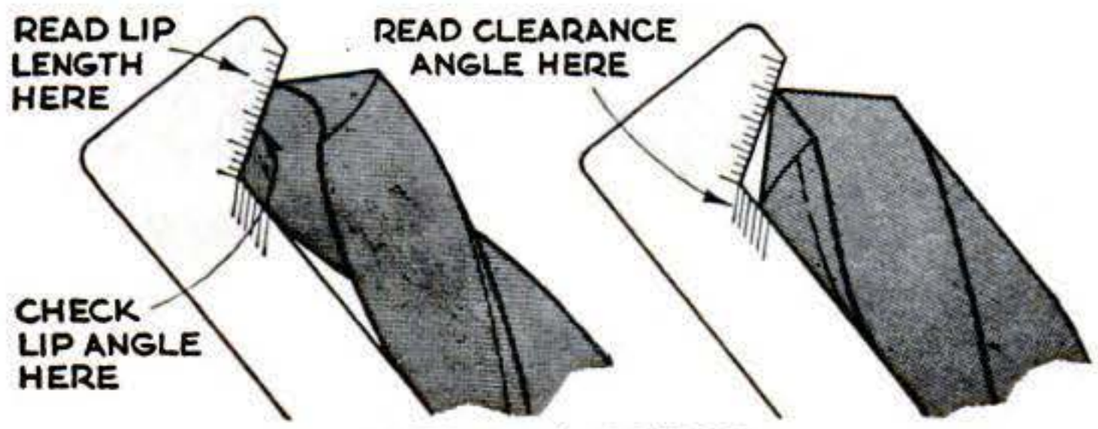


"Hey, I got the clearance angle all right. But not that line at the tip."

Jim nodded. "Your chisel edge is off. Try again, a bit higher on the wheel."

As Larry did so, Jim produced a gauge. "Check the lip angle and lip length on this. If they aren't the same on both sides, the point won't be on center. The drill will make an oversized hole."

Larry held gauge and drill up toward the



USE OF A GAUGE

light. Then he turned the drill halfway to check the opposite side.

"They're way off," he said, crestfallen.

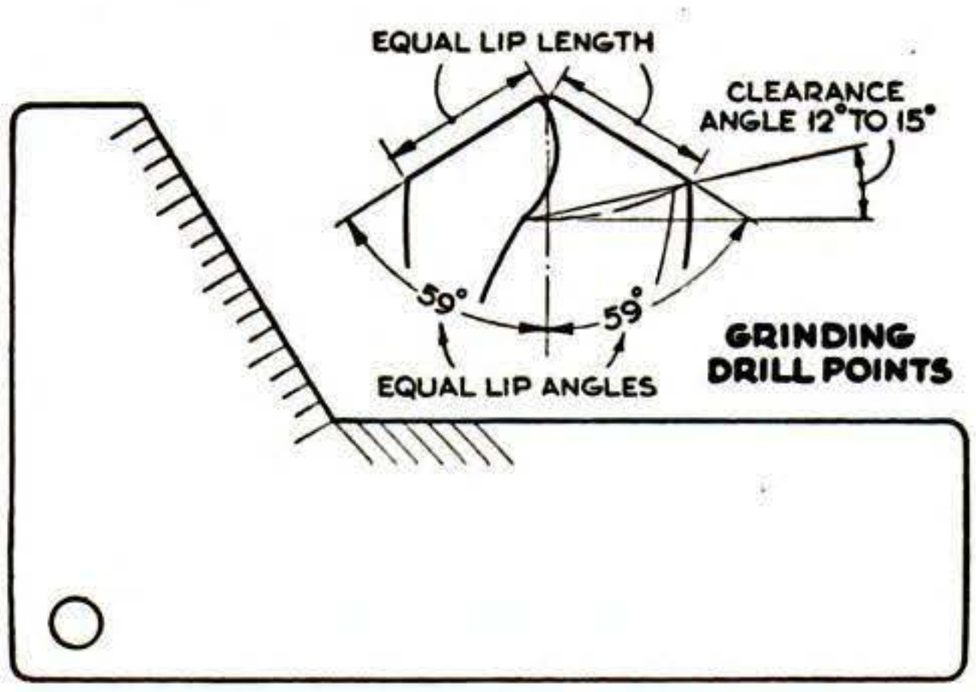
"So what? Grind the short lip."

Larry did so, and again checked.

"Make it a habit to grind both sides with the same pressure and the same number of touches on the wheel," said Jim. "Now hold the heel in the gauge. Are the clearance angles equal?"

"Not on the button, but close."

"Then you're ready to try it."



DRILL-POINT GAUGE (CEMENT ON SHEET METAL AND CUT OUT)

Eagerly Larry chucked the drill and ran it down against a piece of scrap. Then he began to frown.

"It cuts, but mighty slow," he said.

"Let's have a look." Jim took out the drill. "It's a pretty old one, isn't it?"

"Yeah. Does it matter?"

"Only after a drill has been ground so often it's considerably shorter. In a new drill, the web between the flutes tapers toward the point. When a drill's ground back to where the web is full thickness, it's hard to push into the work and cuts slowly."

"Then this drill's done for?"

"No, you just have to thin the web to about an eighth of the drill diameter. You can do that on a round-faced wheel a bit narrower than the flutes. Grind inside the flutes, mostly on the heel side, and down a distance equal to the drill diameter."

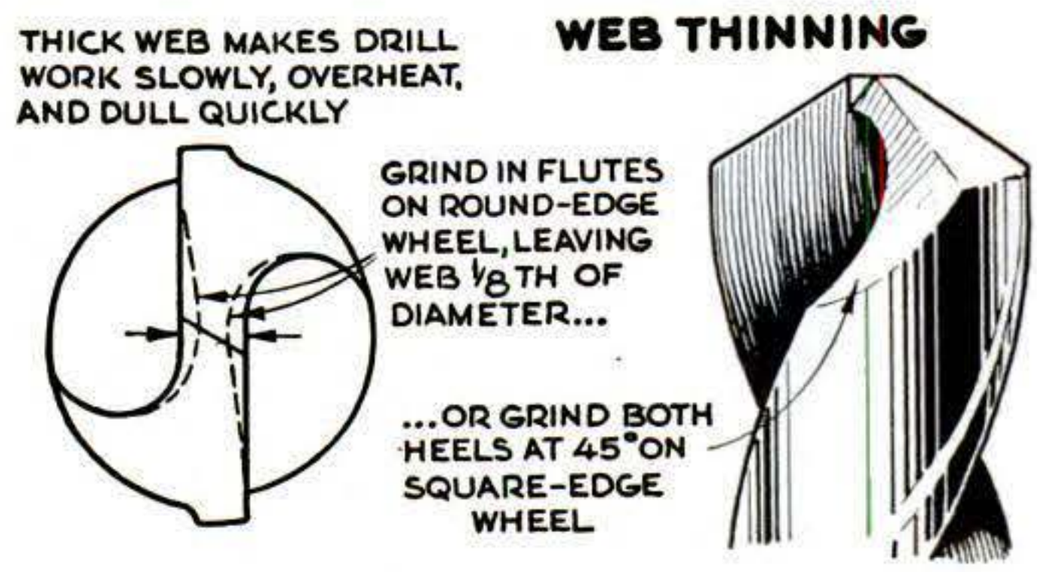
"I haven't got a round-faced wheel."

"Try your little hand grinder, dressing one of its wheels round. Or you can thin a web on a square-edged wheel this way."

Don't Chill High-Speed Drills

Back at the grinder, Jim held the drill against the face of the wheel, lip up, heel in contact with the corner. After a few seconds, he dipped it in water.

"There's another difference between carbon and high-speed drills. You have to be careful not to take the temper out of carbon drills on the wheel. High-speed steel will



stand much more grinding heat, but *shouldn't* be quenched in water right away. Let high-speed drills air-cool a few seconds before dipping, or the edges may chip."

"I see," said Larry. "What did you do just then?"

"Thinned the web by grinding the heels at about 45°. The angles meet at the center of the web. Try it now."

Again Larry chucked the drill. This time chips flowed steadily up its flutes.

"That seems good as new."

"Some industrial drills are ground that

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way for deep holes in crankshafts and con rods. They're called crankshaft points."

Larry, poking through his other drills, handed Jim a bright, new ½" one.

"What's wrong with this one? I know a drill may grab as it breaks through. But this grabbed as soon as I started."

"There's nothing wrong with it."

"Shouldn't be," grinned Larry. "I never ground it. But it grabs."

Jim laughed. "What soft stuff were you drilling?"

"A bronze bushing. How'd you know?"

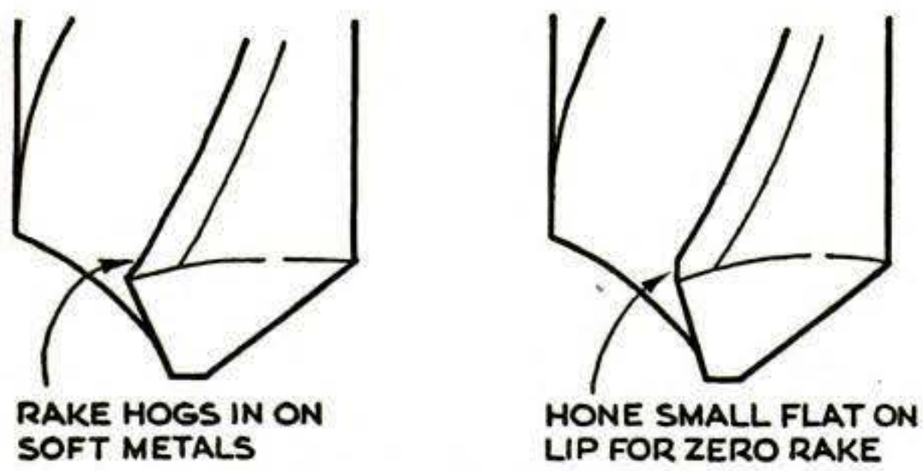
"Just a guess," Jim admitted. "New drills are ground for steel, not brass or bronze. Remember the rake angle that gets under the skin?"

Jim tapped the sketch he'd made. "In soft stuff, it gets under too fast. Next thing the flutes catch, and the drill grabs. You have to grind off the rake."

"But then it's no good for hard stuff."

"True. But you needn't change the rake on smaller drills. It's the big ones that hog in. Watch this."

With a small triangular stone, Jim worked briefly on both lips of the drill.



ALTERING DRILL FOR BRASS

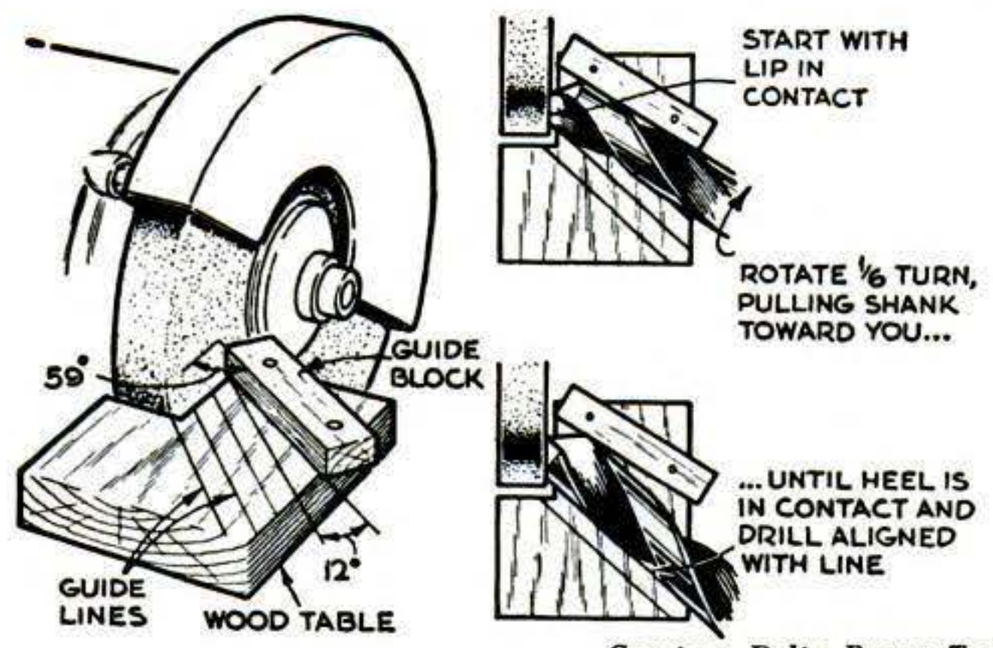
"You see, I stone a vertical face on both lips, only a hair wide, but that's enough to kill the rake angle at the lip, where it counts. To use the drill in steel afterward, all you have to do is grind it enough to make the flat disappear."

"I get it now. But I'll leave it like this until I've opened out that bushing. Say, will I get a good running fit without having to use a reamer?"

"You can come pretty close if you first use a drill 1/64" undersize. Then run this one through, but hold it so it can 'float' and center itself in the hole. If you hold it rigidly ever so little off center, it will drill the hole oversize."

"Thanks. I'll clamp it in the taper-shank chuck and rest the chuck shank on the tailstock center in my lathe. How about that jig for grinding drills on the rest?"

"It's a simple gadget, like this." Again the pencil came out. "Clamp or bolt an L-shaped piece of wood to the rest, and nail on a guide strip at 59° to the side of the



Courtesy Delta Power Tools

wheel. Draw a few guide lines at 12° to the strip to gauge the relief angle.

"Hold the drill against the guide strip, with the lip touching the wheel. Pull the shank end toward you, and turn the drill clockwise until, by the time the drill is parallel to one of those 12° guide lines, you're grinding the heel."

Larry took the sketch. "I'll try it."

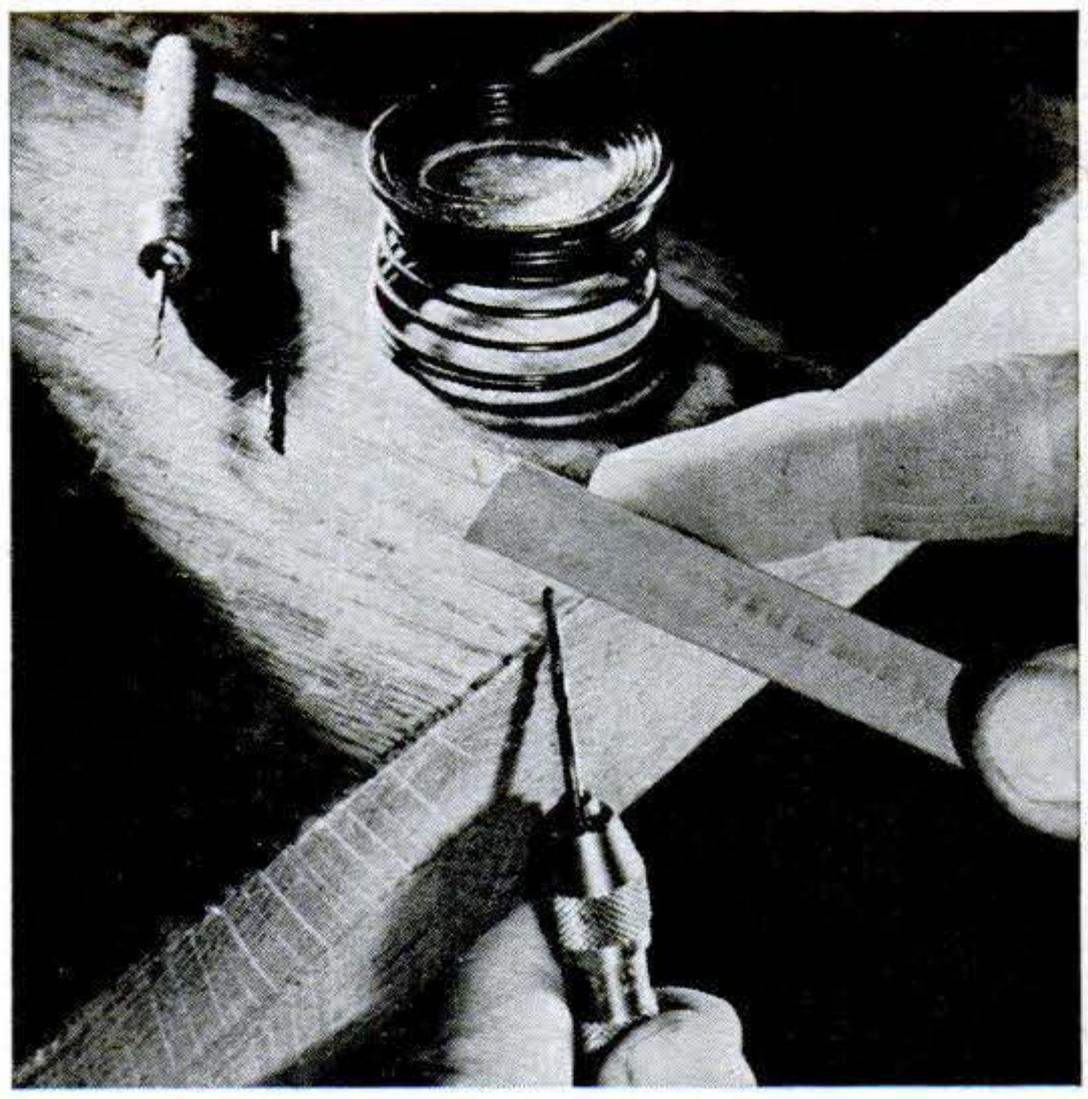
He returned to the drill press, while Jim marked out a setscrew hole on the hub of a tiny flywheel he was making.

Moving a Hole Over

A few minutes later, Larry held two pieces of stock together and shook his head.

"I fouled this up," he grumbled, as Jim joined him. "See? With a rivet in this pair of holes, the one I've started under this other hole doesn't line up."

[Continued on page 240]



TO POINT SMALL DRILLS, square off on wheel, then stone with India stick held at 59° angle. Twist into soap until chip spirals are equal.

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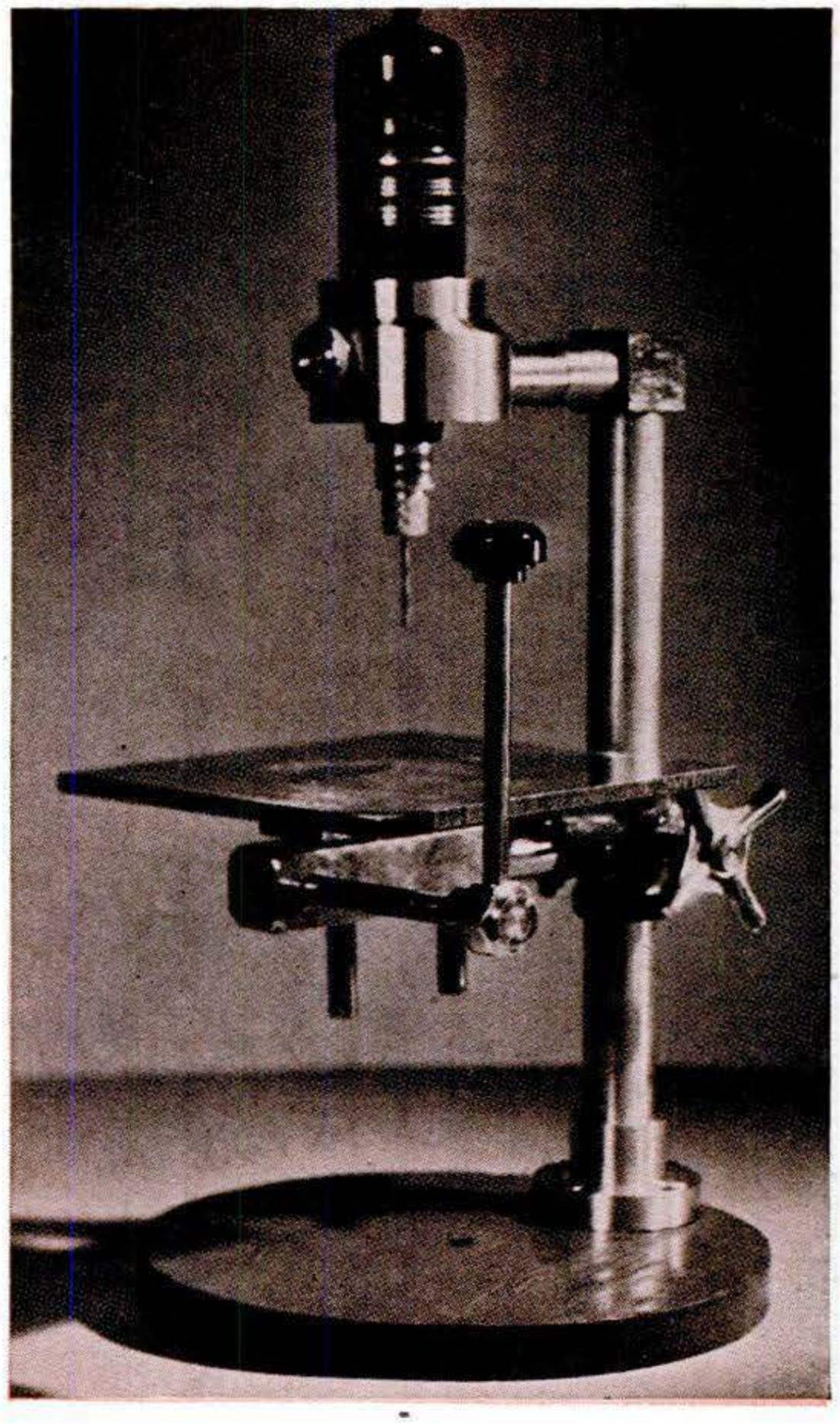
Making a High-Speed Drill Press

By Bill Luther



EVEN if you have a regular drill press, you'll find this little hole maker almost worth its weight in drills. It spins the tiny ones (Nos. 55 to 80) at the fast clip necessary to keep them cutting without breakage —and the holes are square with the table every time.

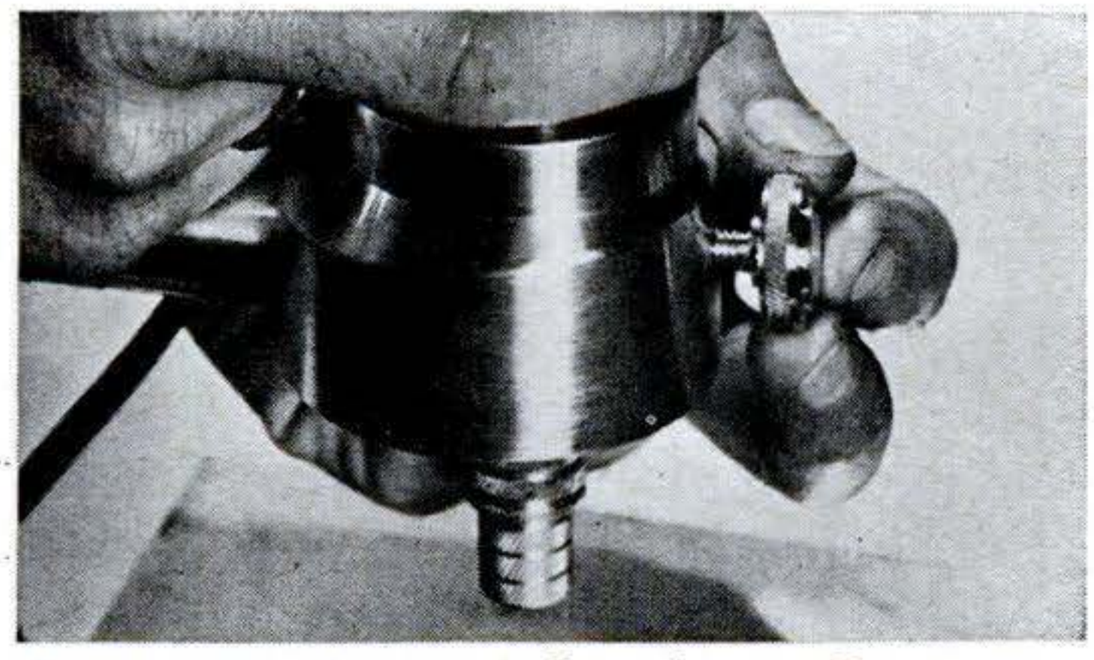
The high-speed power source may be a hand grinder or the motor from a retired vacuum cleaner. Both types run up around 18,000 r.p.m. With a foot rheostat from an electric sewing machine, you can regulate the speed. The table has a vertical movement of 1½", and is adjustable on the column for a distance of 6".

Making the column. This can be a piece of 1" pipe turned smooth in the lathe and screwed into a floor flange, or heavy-walled tubing held in a flanged turning with setscrews. If pipe is used, the right-angle fitting at the top of the column may be an elbow, and the motor arm threaded to fit.

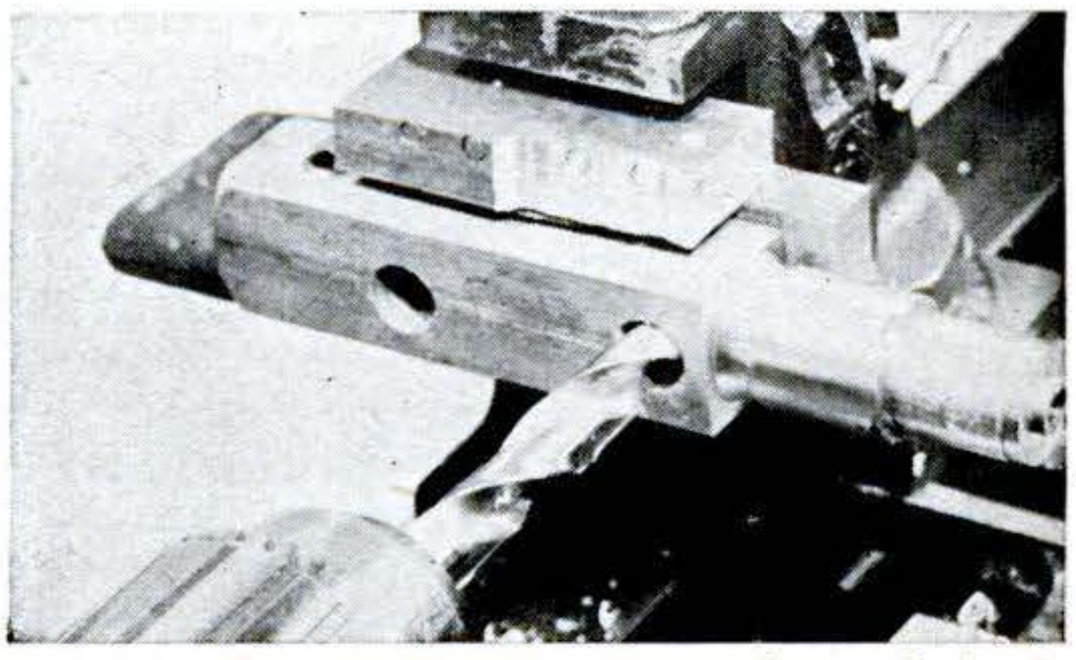
Bore out a pipe tee to slide on the column without shake, and tap for a locking screw. Drill and tap the right-angle arm of the tee for a setscrew to lock the horizontal table support in position and prevent any tilt.

The column is topped with a motor-support arm. It carries a turned collar bored off center to fit the hand grinder. To drill the ½" hole for the support arm at exactly 90° to the bore, mount the collar on an angle plate or in the milling attachment.

Drill and tap holes for the setscrew and grinder clamping screw. The latter should



AN ADAPTER COLLAR is bored out off center to a close fit for the hand grinder. It is then chucked from inside to turn the upper shoulder. The retaining thumbscrew is shouldered to keep it from entering too far.



DRILLING THE GUIDE-PIN HOLES through both the table support and the pad at the same time will insure alignment. Do this with the parts clamped together in the milling attachment as above, or on the lathe faceplate.

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have a collar or washer to prevent it from entering too far.

Make the table support from 1″ by 1″ mild steel or similar stock. If the column tee is a pipe fitting, thread the end of the support for a tight wringing fit in it. Bronze bushings in the guide-pin and spindle holes are optional, but desirable for long service.

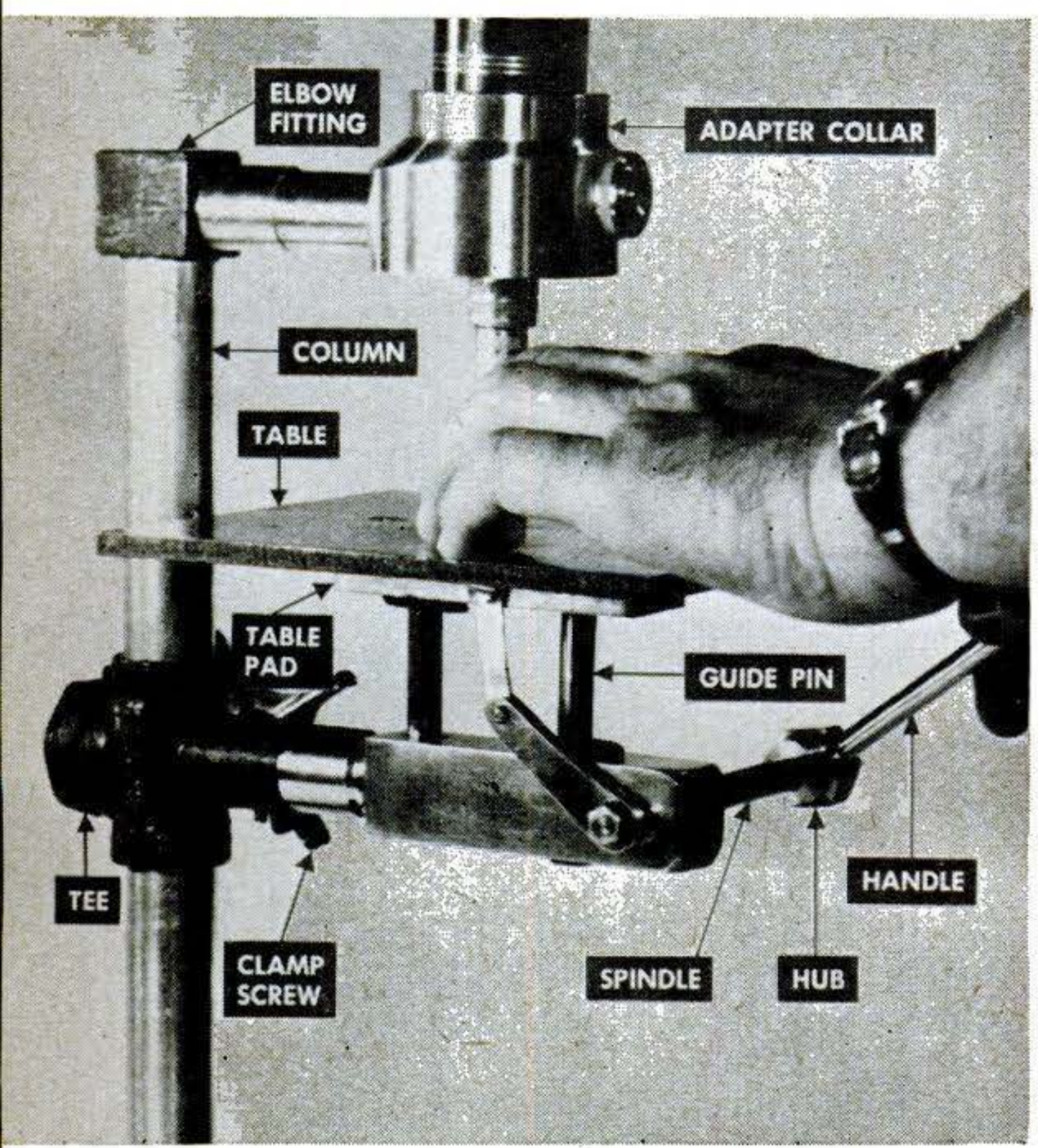
Pins and spindle are drill rod turned between centers in the lathe. The pins are locked into the table pad with headless setscrews. The feed lever is a piece of ¼″ rod threaded at both ends. It is fitted with a knob and threaded into a turned hub on the spindle.

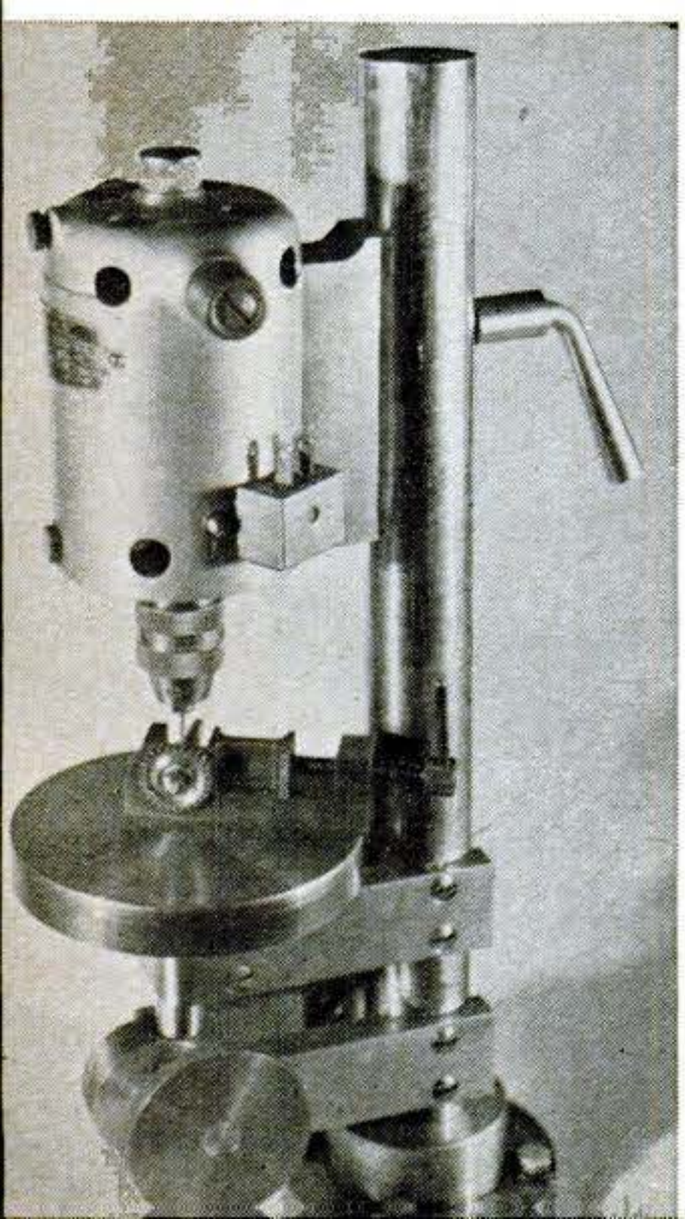
Saw and file the lift lever and link to shape from sheet steel or brass. Screw the lift spindle tightly into the lever with a drill-rod washer on each side, and jam a 10-32 nut against the outer one.

Assembling the press. Screw the column base to the bench or a foot cut from 1″-thick wood. Slide on the table assembly and mount the motor-support arm and collar. The table may be any flat piece of 3/16″ or ¼″ stock. With the grinder in place, check alignment of table and motor spindle.

For a vacuum-cleaner motor, an adapter or mounting plate will have to be made to suit. Thread the shaft, or mount a threaded collar on it, to fit a small drill chuck. Collar and chuck must run dead true.

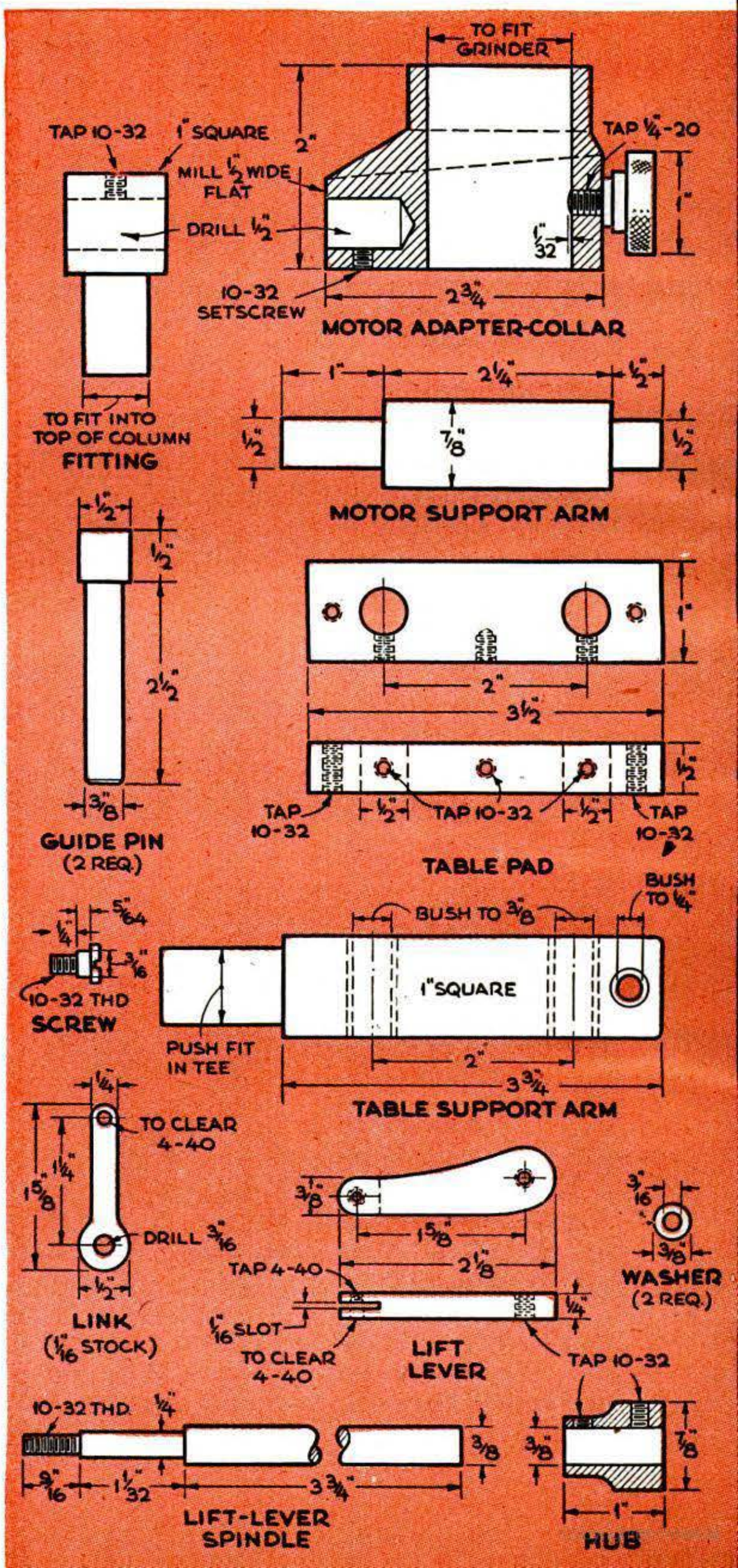
See PS next month for practical pointers on using compressed air in the home shop.



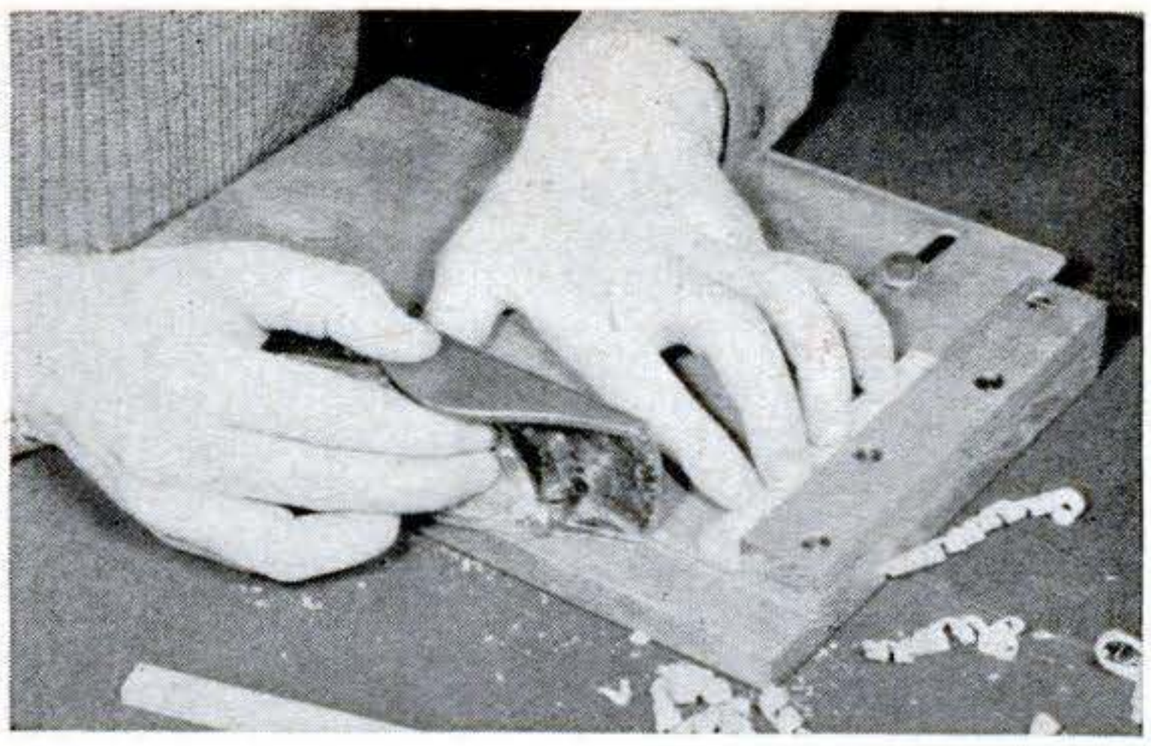


MOUNT THE TABLE, a piece of flat stock, on the pad with countersunk bolts. The sliding column mount on the press above was made from a four-way hydraulic fitting. Other parts were turned.

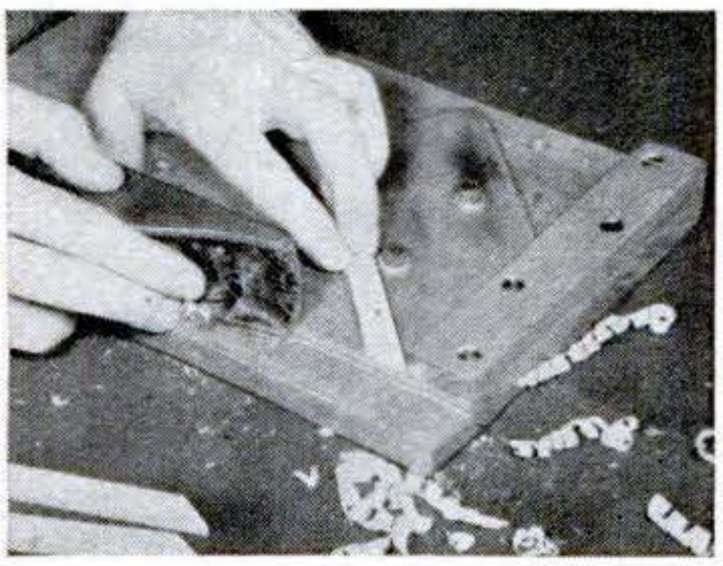
HERE'S ANOTHER. In this big-motor model, the table is raised by a cam. The table support is fixed on the column, but the motor position is adjustable. It was designed by C. W. Woodson.



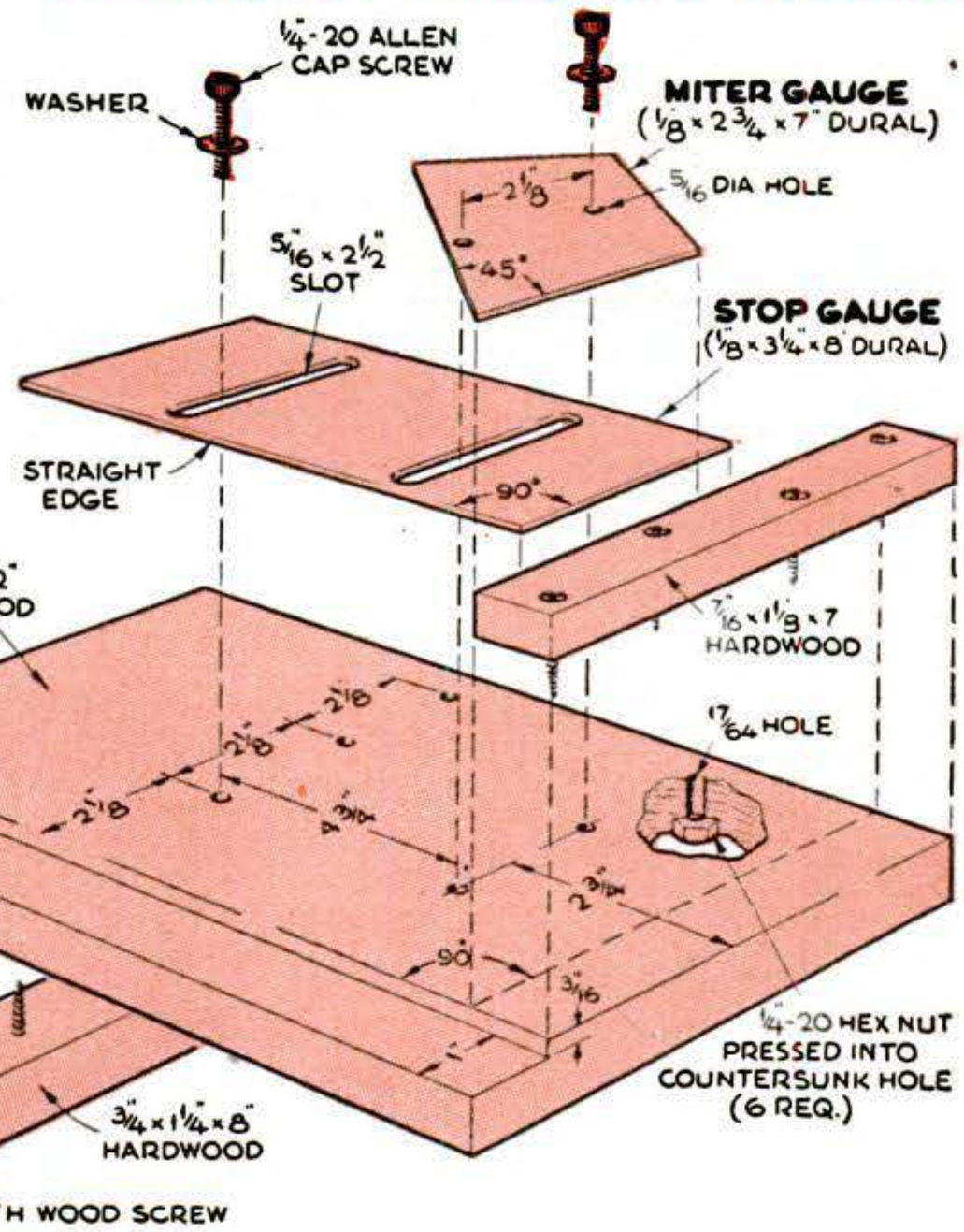
Planing Block Makes Exact Cuts



ENDS CAN BE SQUARED or edges straightened by setting up the adjustable stop gauge like this.



MITERS CAN BE CUT by holding work against miter gauge. Block rabbet guides plane.



FUNCTIONS of a bench hook, shooting board and miter box are all combined in this homemade planing block. Set it up on your bench and you can use a common wood plane for precise woodworking cuts—perfectly straight and square edges and ends, and tight miter joints. It is especially good for working small stock.

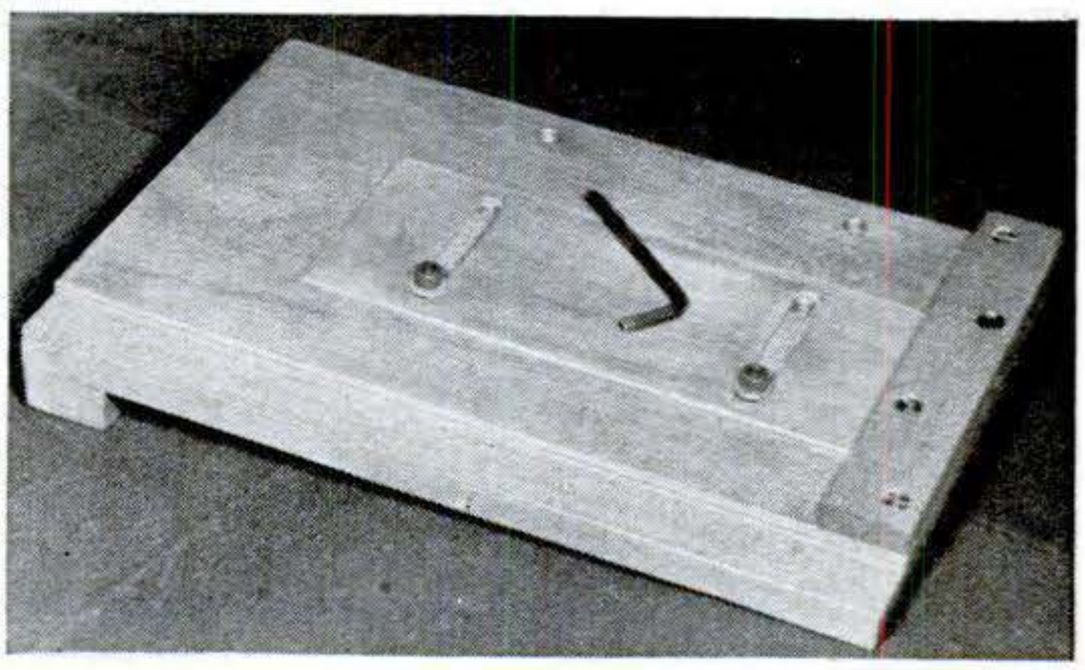
A 3/16" by 1" rabbet along one edge of the block guides the plane. Interchangeable stop and miter gauges, made from ⅛" dural or brass, locate the work. For accurate cuts, all edges and angles must of course be right on the nose.

Use close-grained hardwood for the block, bench stop and cross bar. The plane-guiding rabbet can be made with an end mill or router in a drill press, or by a careful pass on the circular saw. Drill the six 17/64" holes in the block to align with the slots and holes in the gauges. Then press hex nuts into sockets chiseled out of the bottom face of the board. To mark the sockets before chiseling, mount a nut on a pilot screw, insert the screw into each of the 17/64" holes and tap the nut firmly to leave an outline.

Assemble the bench stop and cross bar to the block with glue as well as screws. Before finally tightening the screws in the cross bar, check to make sure the bar is exactly 90° to the plane guide. This setting determines the accuracy of all work that will be done with the block.

The two slots that permit transverse adjustment of the stop gauge can be cut out on a drill press or drilled and filed by hand. Polish both gauges.

Practically any small plane will work with the block, the main requirement being a razor-sharp blade set square in the plane. In using the block, rough-saw the parts to size first. Then use the block and plane for the final finicky finishing operations.—*J. C. Magee, Schenectady.*



AN ALLEN WRENCH locks gauges in position. Two cap screws are enough for either gauge.

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New Shop Ideas

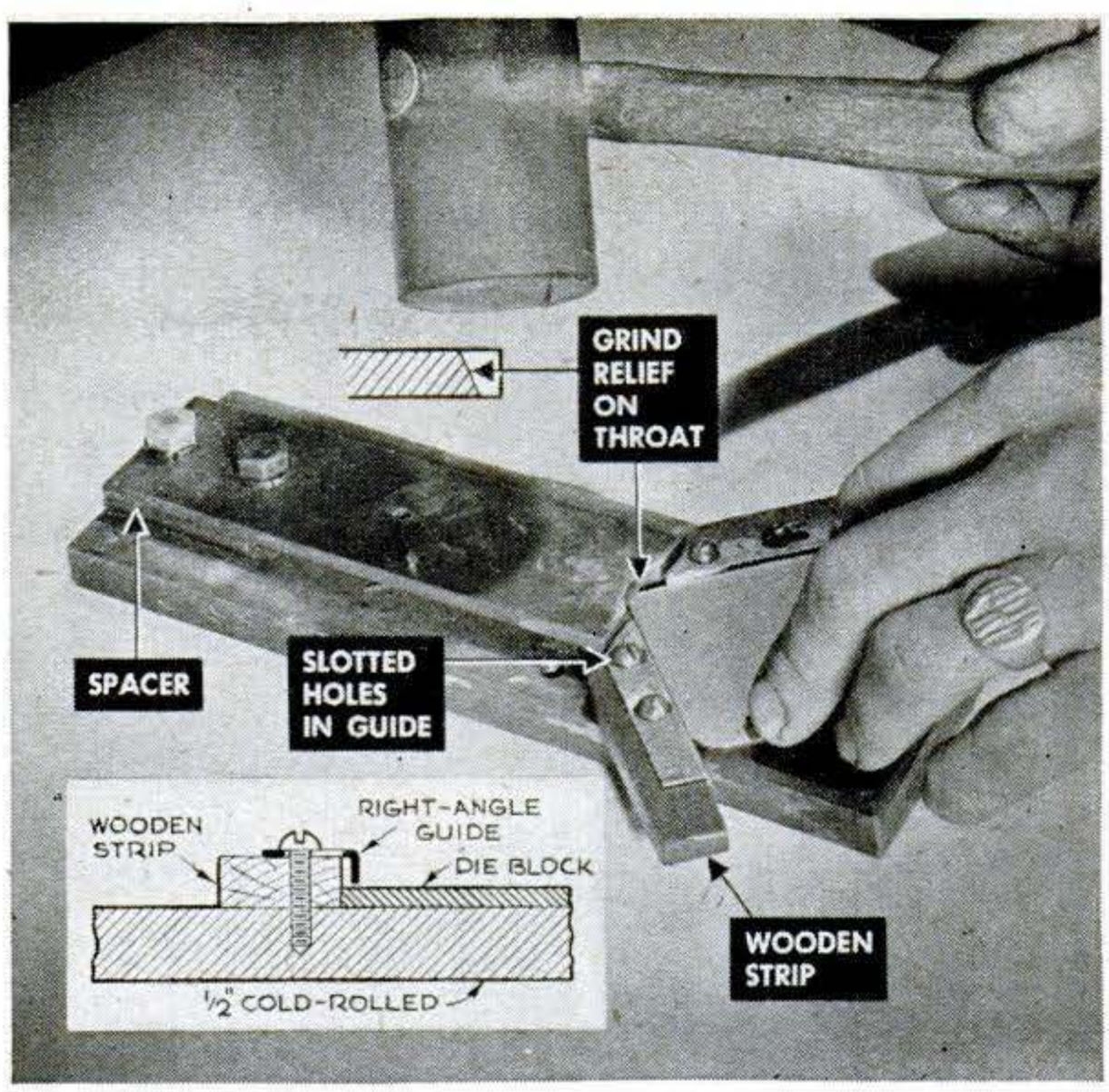
Punch Forms Radius. A light hammer blow on this punch puts a clean corner radius on sheet iron up to 1/32″.

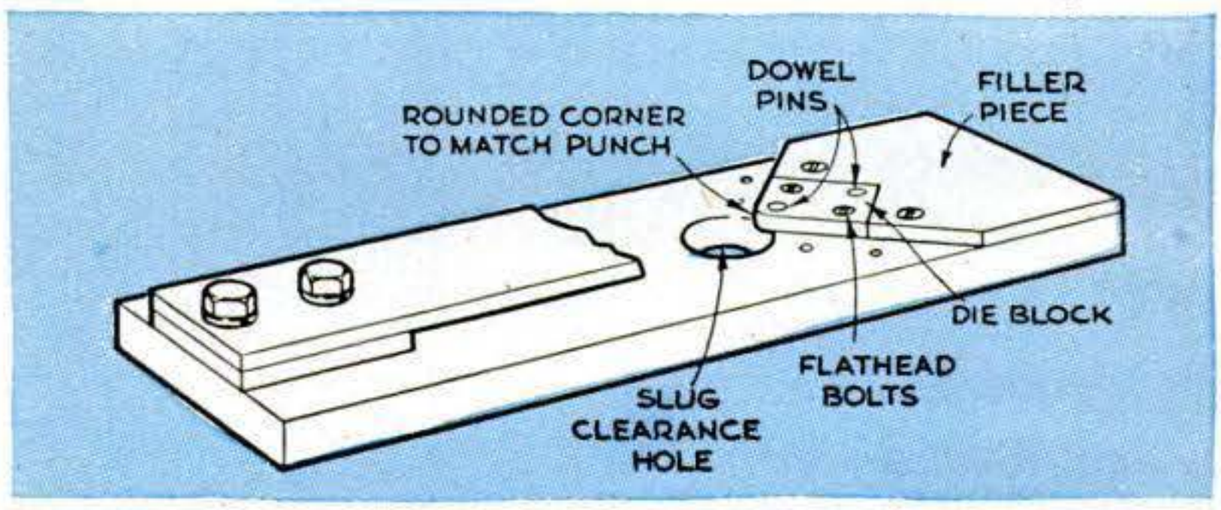
Pieces of an auto spring leaf form the punch and die block. Anneal one end of a 6″ length and drill it for 5/16″ cap screws. Grind the punch throat in the other end, forming a clearance angle as in the photo.

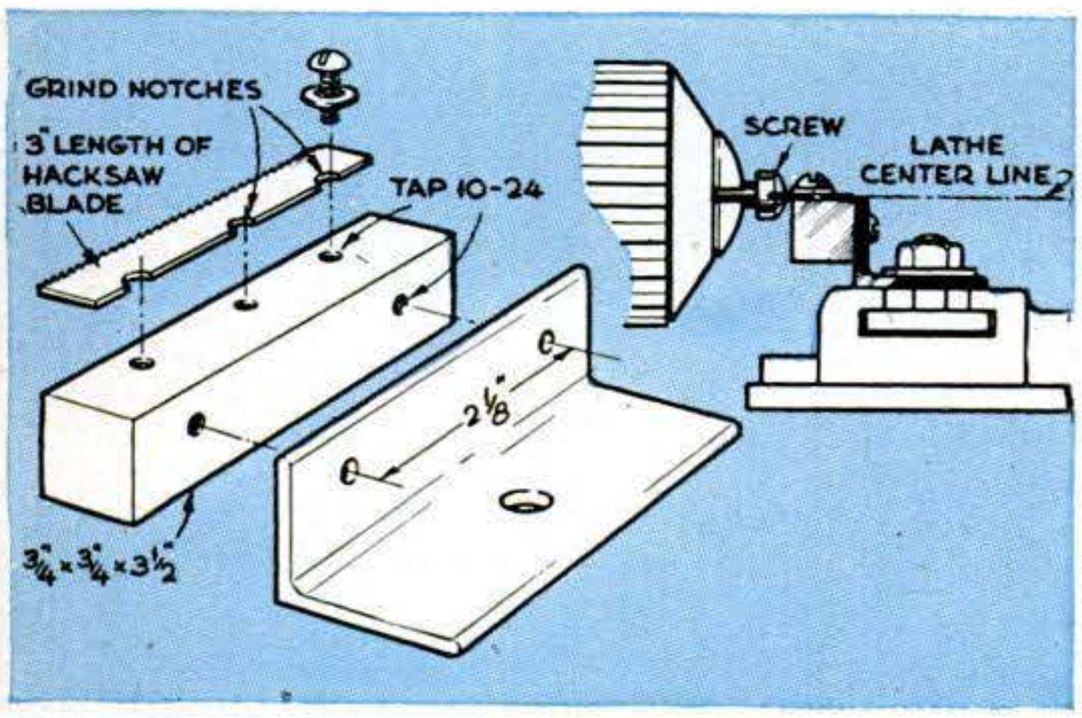
Mount the punch on a ½″-thick base with a spacer, either tapering this or inserting a shim to raise the throat end just enough to admit the work.

Anneal a piece for the die and drill it for two dowel pins as well as bolts. Shape a corner to match the punch radius, but with no clearance angle. Reharden the die and draw it to a dark straw before mounting it. A filler piece enlarges the work-holding area.

Slotted guides, cut from angle or bent from sheet metal, permit adjustment from a rounded point to the full throat radius.





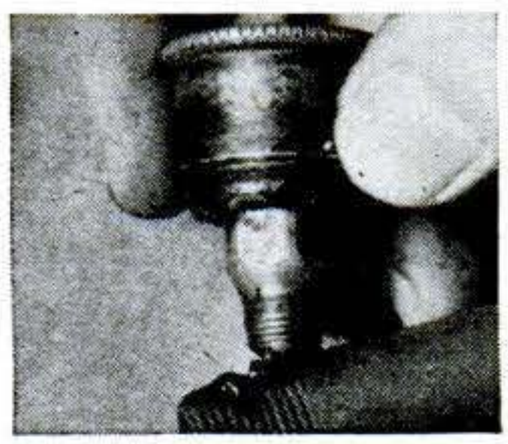


Slotting Screw Heads. An off-center or crooked slot spoils the screw. The setup above cuts the slot accurately on the lathe.

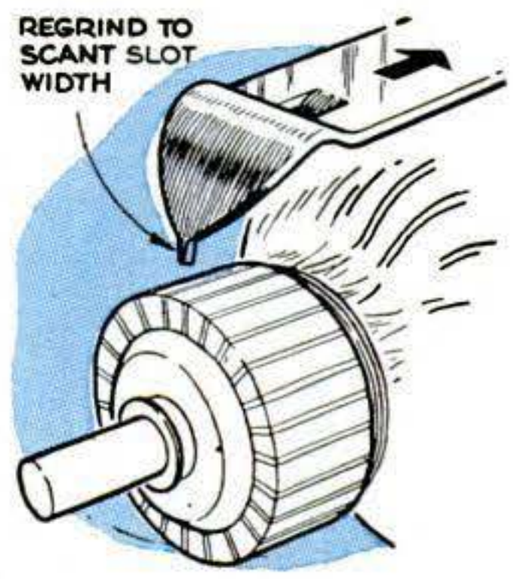
Clamp a piece of angle iron on the compound, parallel to the slot, with a stud or bolt threaded into a shoe. Mount a piece of square cold-rolled steel on the vertical flange just below lathe-center height. On the upper face bolt a short piece of hacksaw blade, its thickness straddling the center line. Use shims if necessary.

Swing the compound parallel to the ways and feed the blade in with it. Make the cutting stroke with the cross feed, full blade length.

Odd Jobs for Grease Cups. Cleaned out with kerosene, old grease cups have several uses. They're handy for carrying small amounts of grease or graphite paste, white lead, soldering paste, or pipe-thread compound. For the pocket or tool kit, close the open end with a pipe cap or plug it with a match.—*W. E. Burton, Akron.*



Can Opener Undercuts Mica. An occasional job of turning down a commutator doesn't warrant buying a mica-undercutting attachment. I've done a good job with a beer-can opener ground like a parting tool, with the business end a bit narrower than the commutator slots. Side and rake angles are ground to let it cut on the pull stroke.—*L. W. Bonnell, Fort Worth, Tex.*



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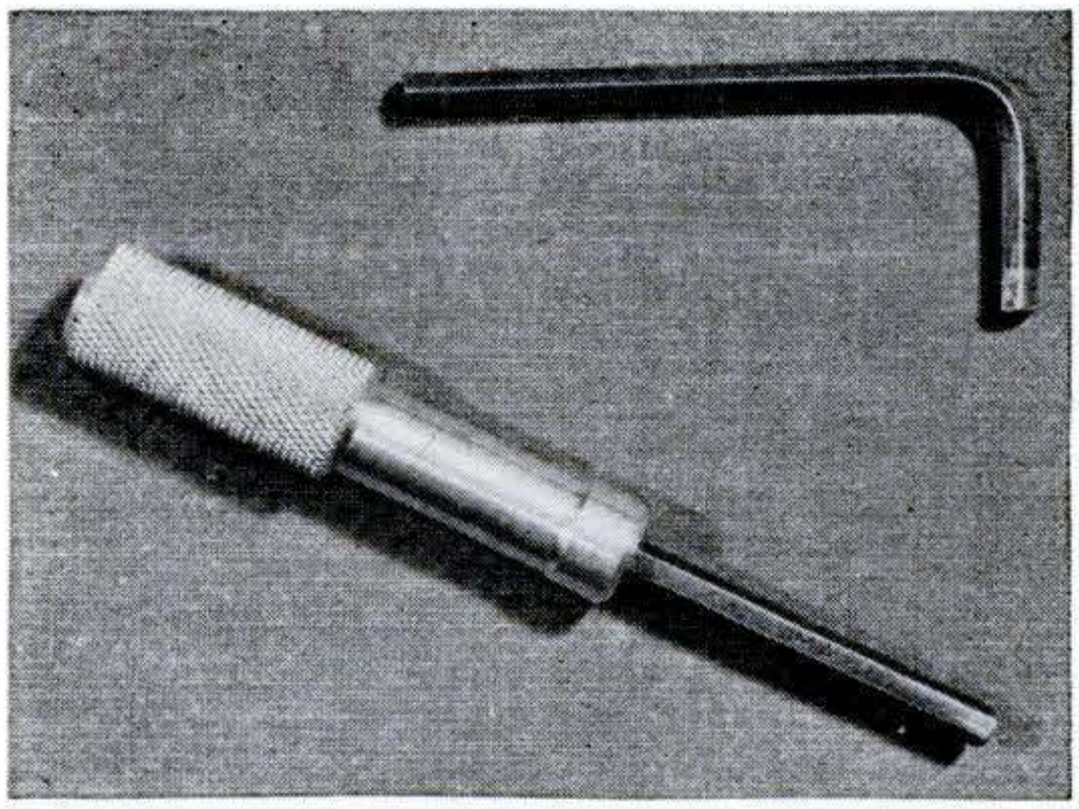
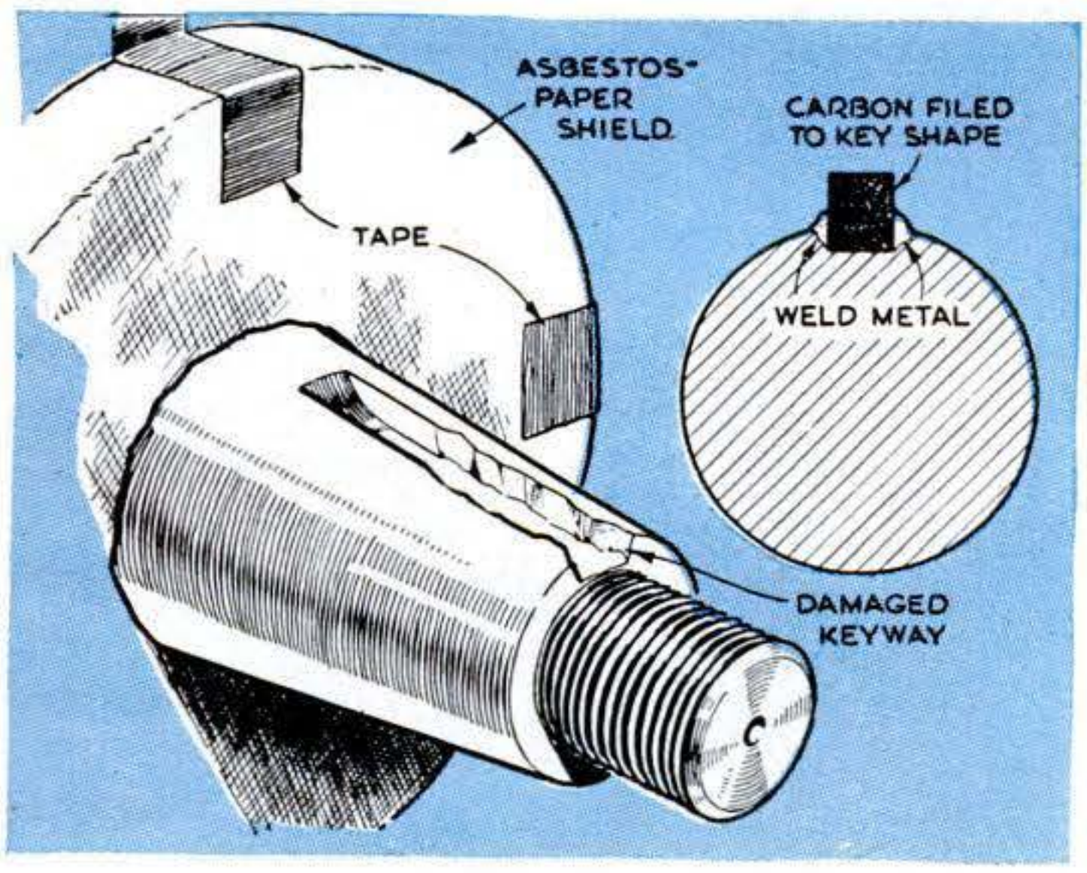


Hex Screwdriver. This is a fast tool for running in hollow-head screws and a handy supplement to the regular Allen wrench. Even a complete set is an easy lathe job.

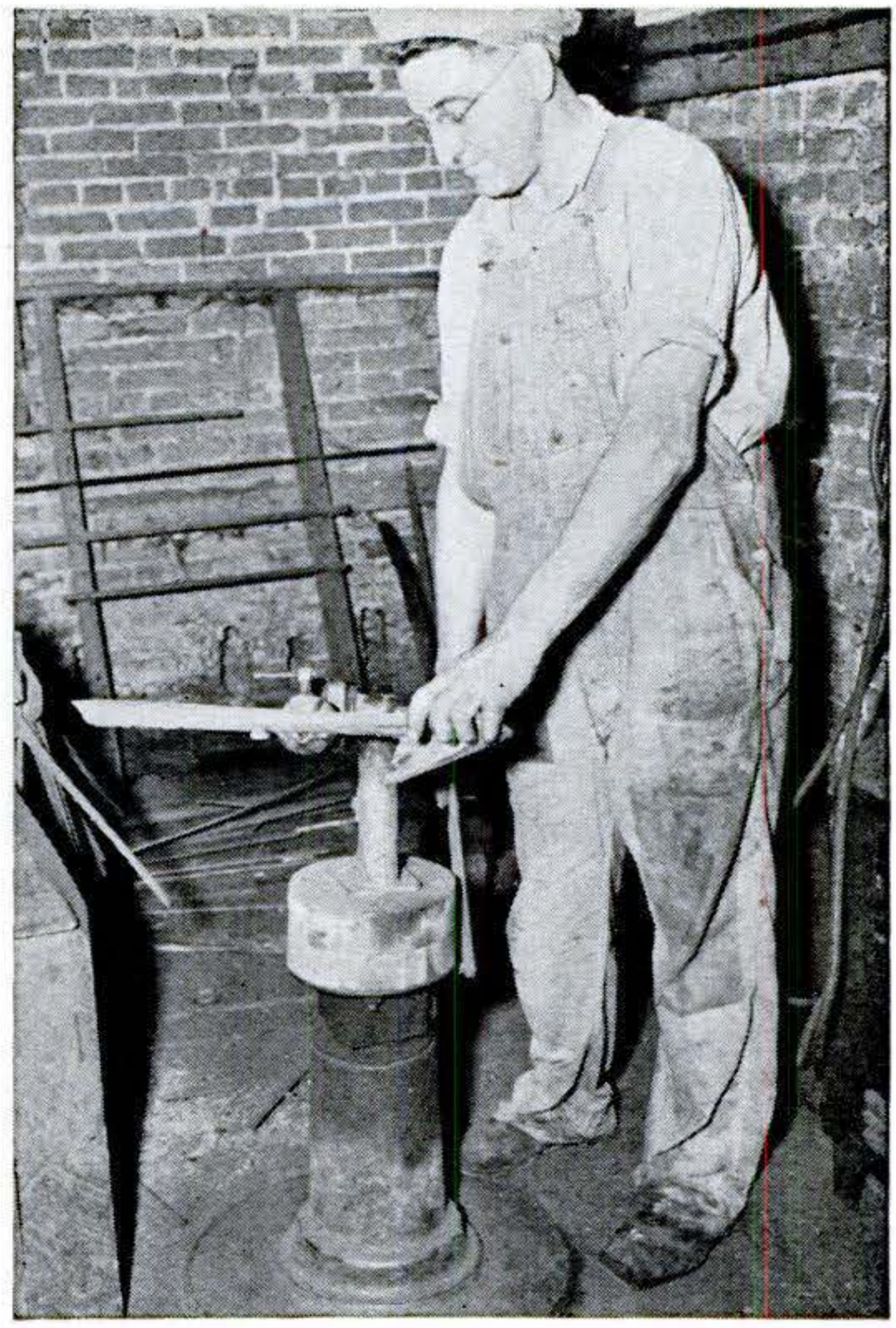
Turn, knurl and drill the handle 1″ deep to a push fit for the bit. Drill ½″ deeper to the across-flats dimension of the wrench. Nick the wrench on a grinding wheel, break it, and grind a chamfer on the end to make it start easily in the smaller hole.—*John M. Avery, Dexter, N. Y.*



Weld Renews Keyway. The keyway on a small engine was so damaged that the flywheel couldn't be keyed on the shaft. I saved the cost, time and labor of fitting a new crankshaft with a simple welding job.

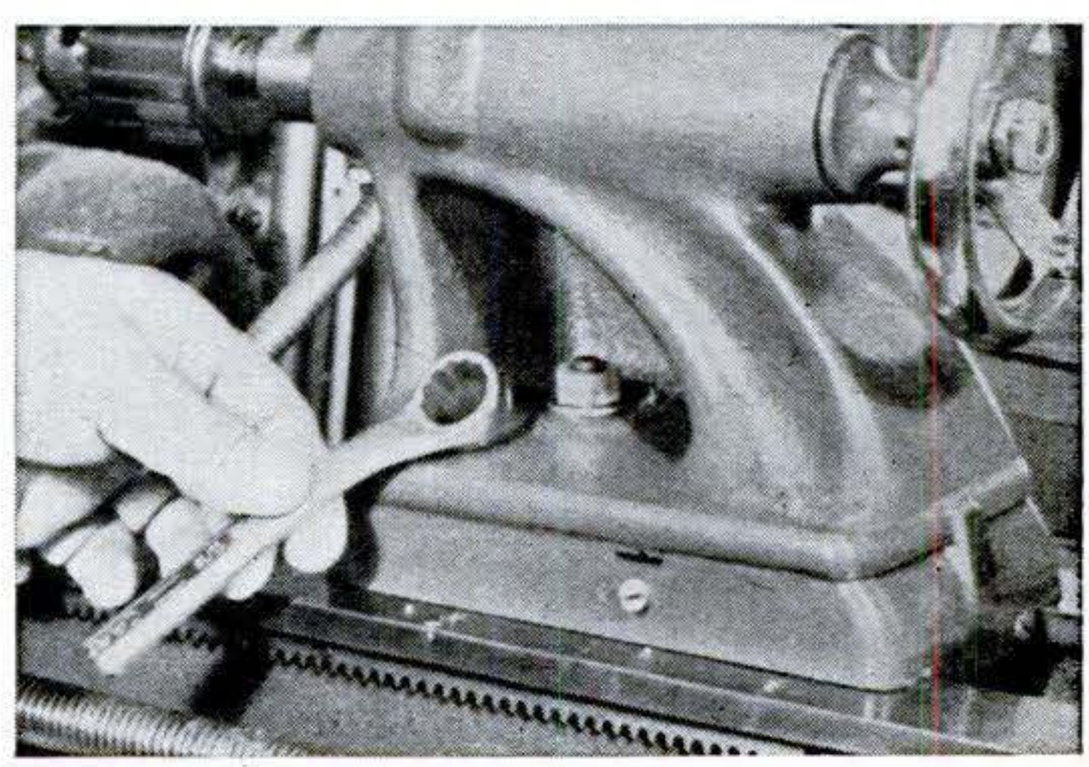
A piece of dry-cell carbon was filed to the shape of the key and held in with tape over the shaft threads. To protect the timer and bearing, an asbestos shield was slipped over the shaft and taped fast.

With a small electrode, I filled in the broken parts along the carbon so quickly the rest of the shaft scarcely got hot. The carbon was removed and the weld ground to match the shaft taper. The whole job took half an hour.—*Evan Wright, Topeka, Kan.*



Barber-Chair Setup. Ed Moellmann, of New Memphis, Ill., found a use for the base of a barber's chair in his blacksmith shop. He mounted two wooden blocks on it and a standard blacksmith's tool holder on top of them. The hydraulic lift makes it easy to raise or lower work to convenient height for filing and other hand operations.—*Grover Brinkman, Okawville, Ill.*

Tailstock Tightener. A 12-point box wrench cut short is just the thing for clamping the lathe tailstock. It stays on the nut better than a hex wrench, but can readily be lifted off for that extra part turn often required.—*Herb Pfister, The Bronx, N. Y.*



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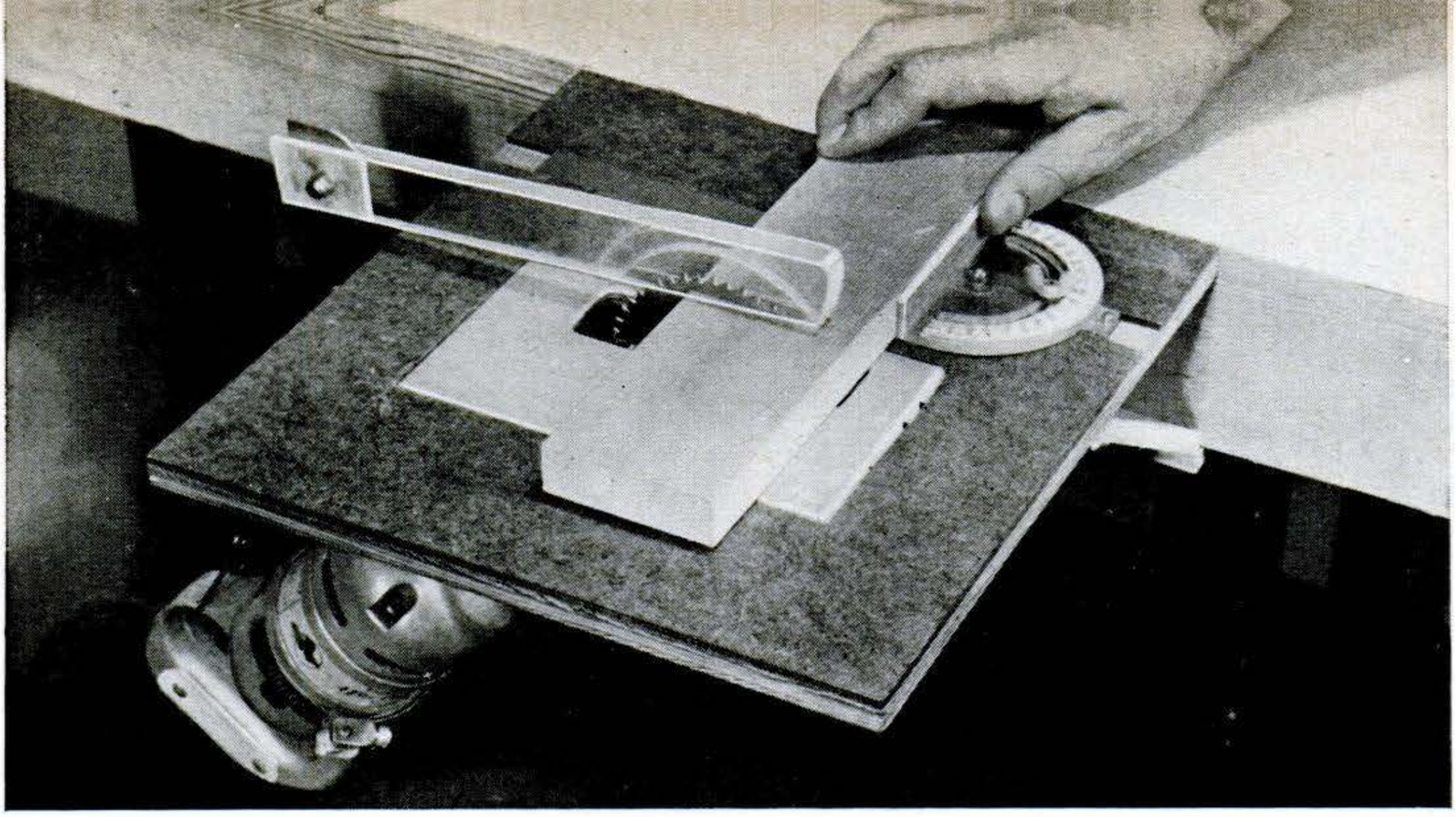
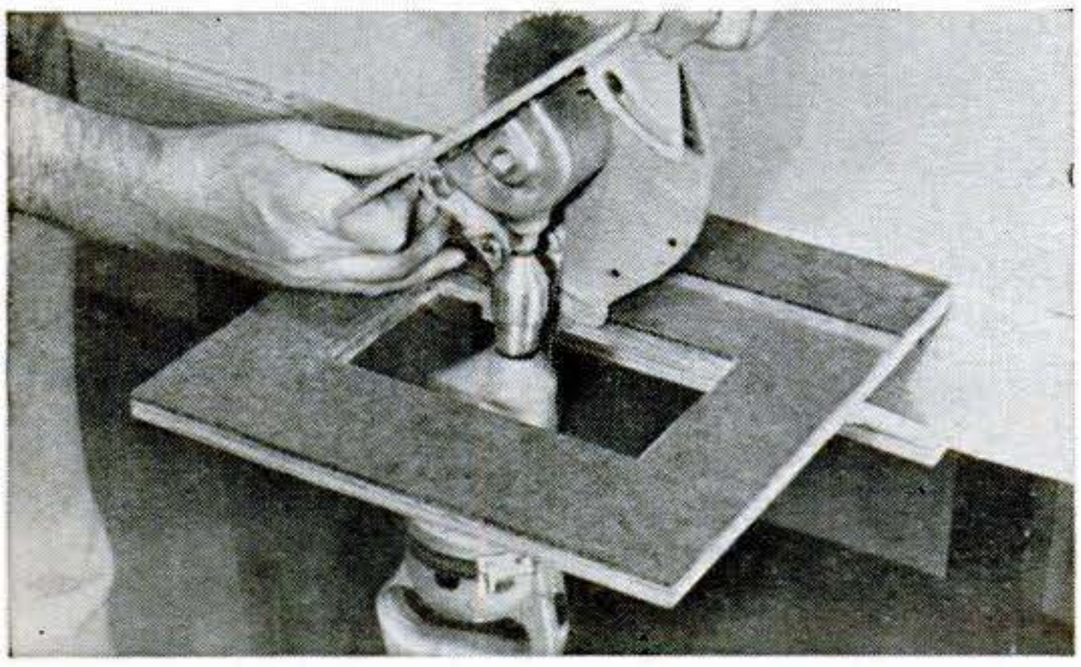


A Homemade Table for Your Electric-Drill Saw

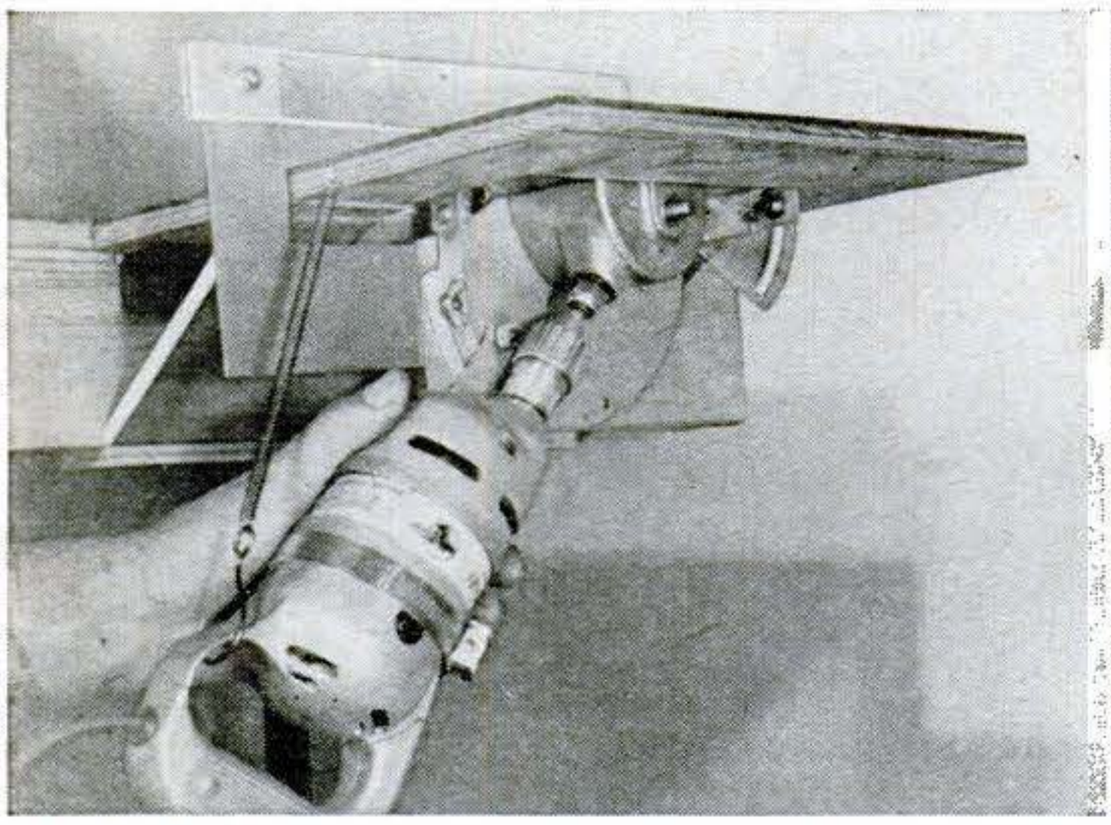


DRILL AND SAW SLIP INTO THE TABLE from the top and are held in place by their own weight. Rabbet in table receives the saw shoe. If drill will not go through, chuck it from beneath.

By M. G. Winterton

SAW attachments for electric drills are now being used in many shops. With this convenient table setup, a drill-powered saw really gets down to work. It easily handles miters, bevels, grooves and dadoes, as well as straight and angle cuts.

You don't have to alter the drill or saw in any way and you can slip them in or out of the table in a jiffy. When the saw is



BALANCING SPRING hooked to table and drill handle takes up some weight and helps steady the saw. Blade-guard support, which is also a splitter, is bolted to saw casting.

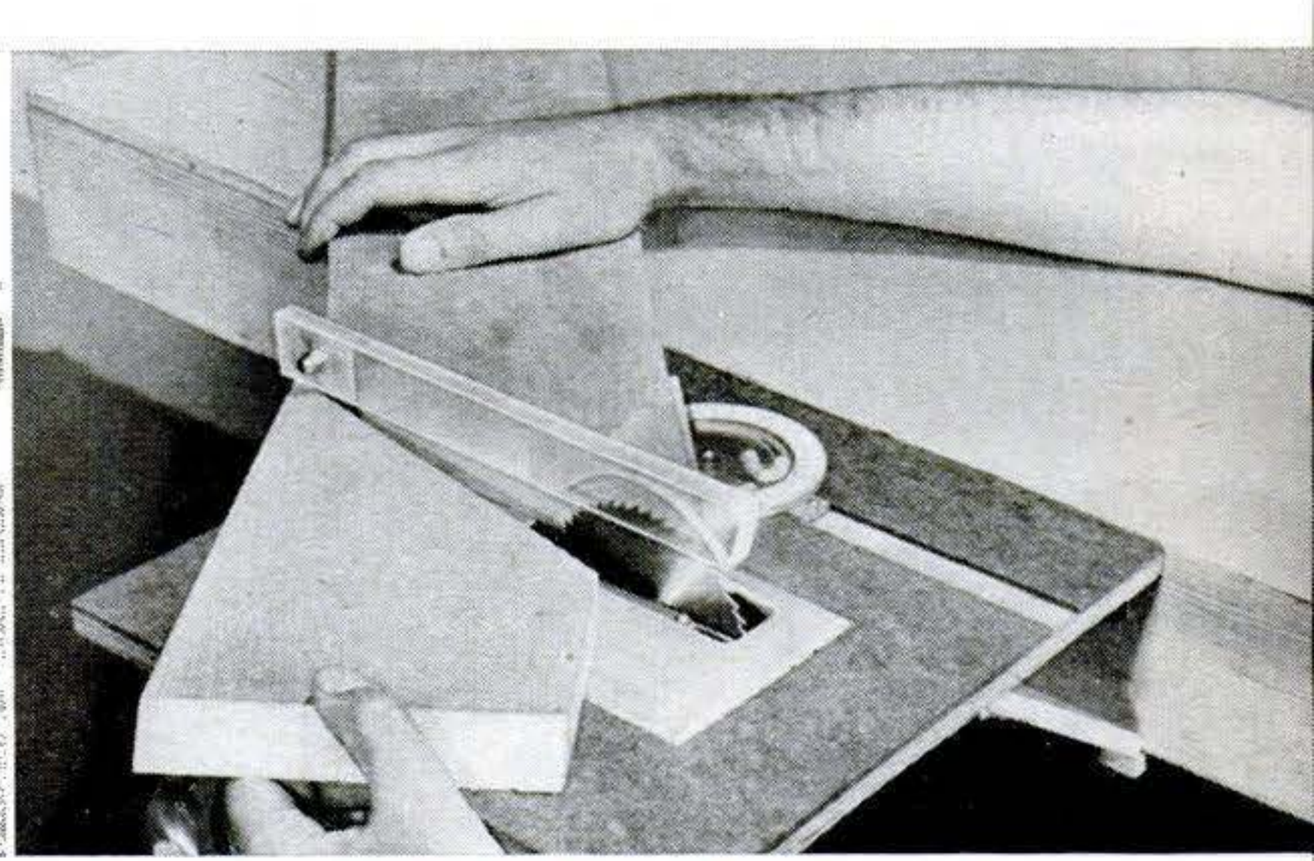


TABLE IS HINGED FLUSH with bench top so bench can serve as table extension. The blade guard rises to suit thickness of work. Most drill saws can handle stock up to 1″ thick.

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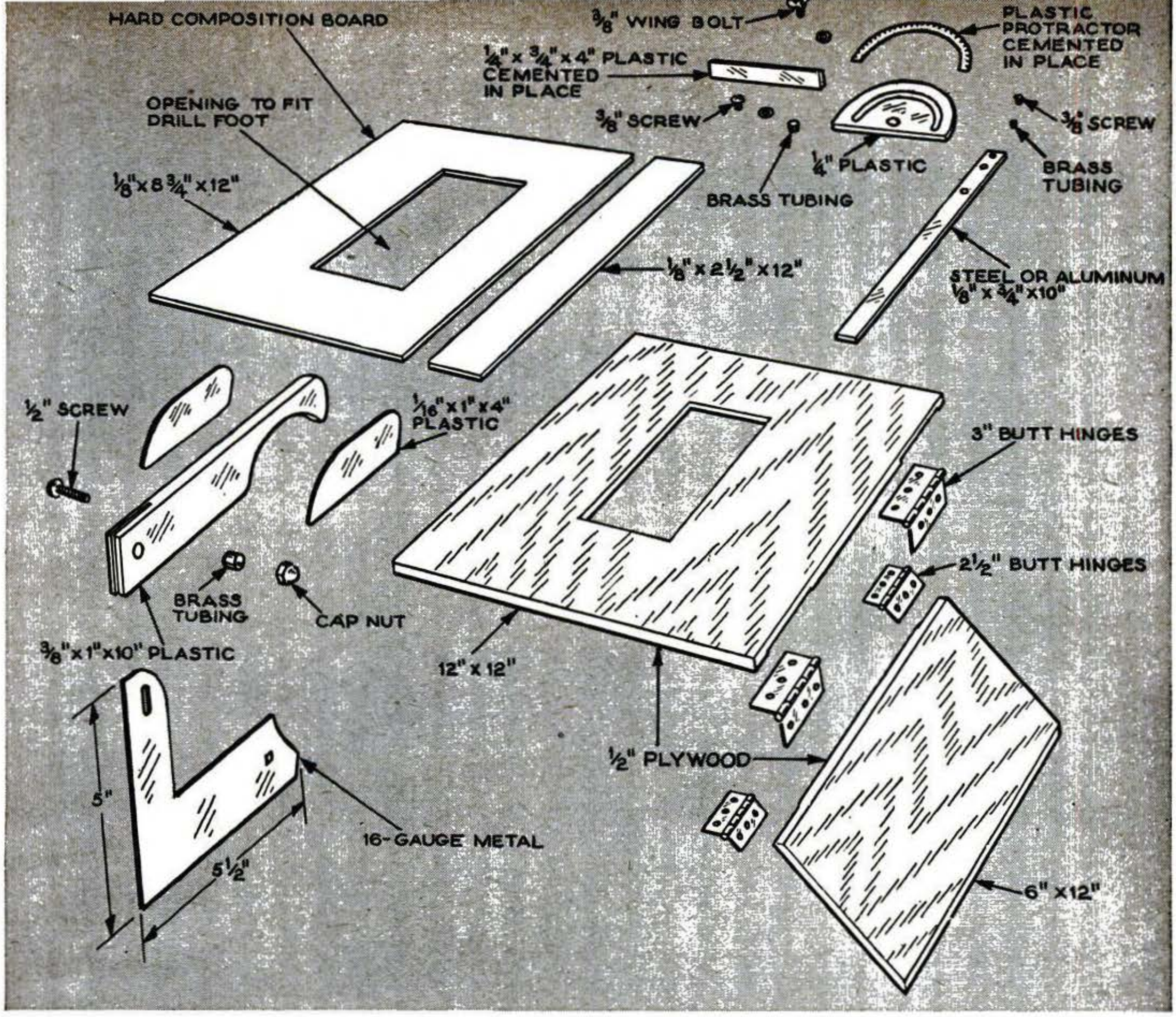
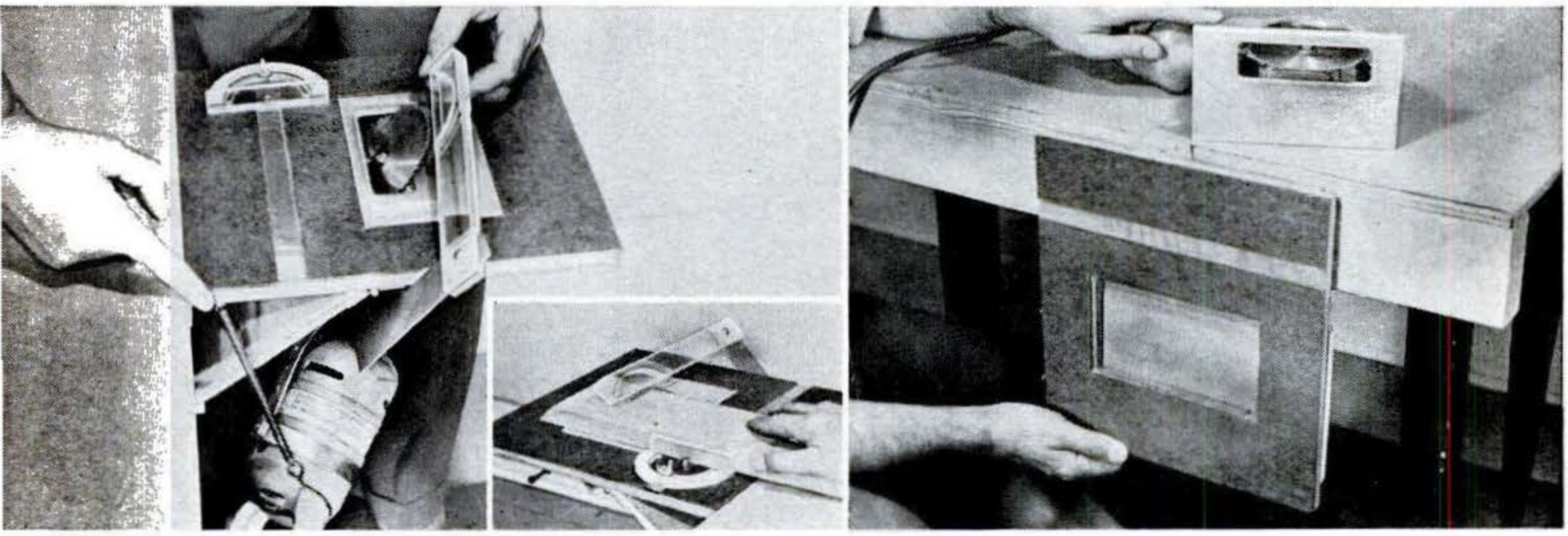


removed, the table folds flat against the workbench. Raised, it is held up by a plywood panel hinged underneath and propped against a cleat on the bench.

Details of the table, miter gauge, blade guard, and hinged support are given in the drawing. Some specifications may have to be altered slightly to fit your saw attachment or drill.

For the table surface use a sheet of hard composition board. Cut an opening the exact size of the saw shoe. Make a similar but slightly smaller opening in a ½" plywood panel and glue the two together so the plywood forms a supporting shoulder or rabbet for the saw foot. The gap that forms the miter-gauge groove must be parallel to the plane of the blade. END



THIS SAW CAN BE TILTED to any angle up to 45°. Balancing spring is moved to other screw at the side. Blade guard slants too. Inset shows bevel cuts made with tilted saw.

TABLE FOLDS UP FLAT against the workbench when saw is removed. Unit may be set up or taken down in a few seconds. Drill and saw, unchanged, can still be used freehand.

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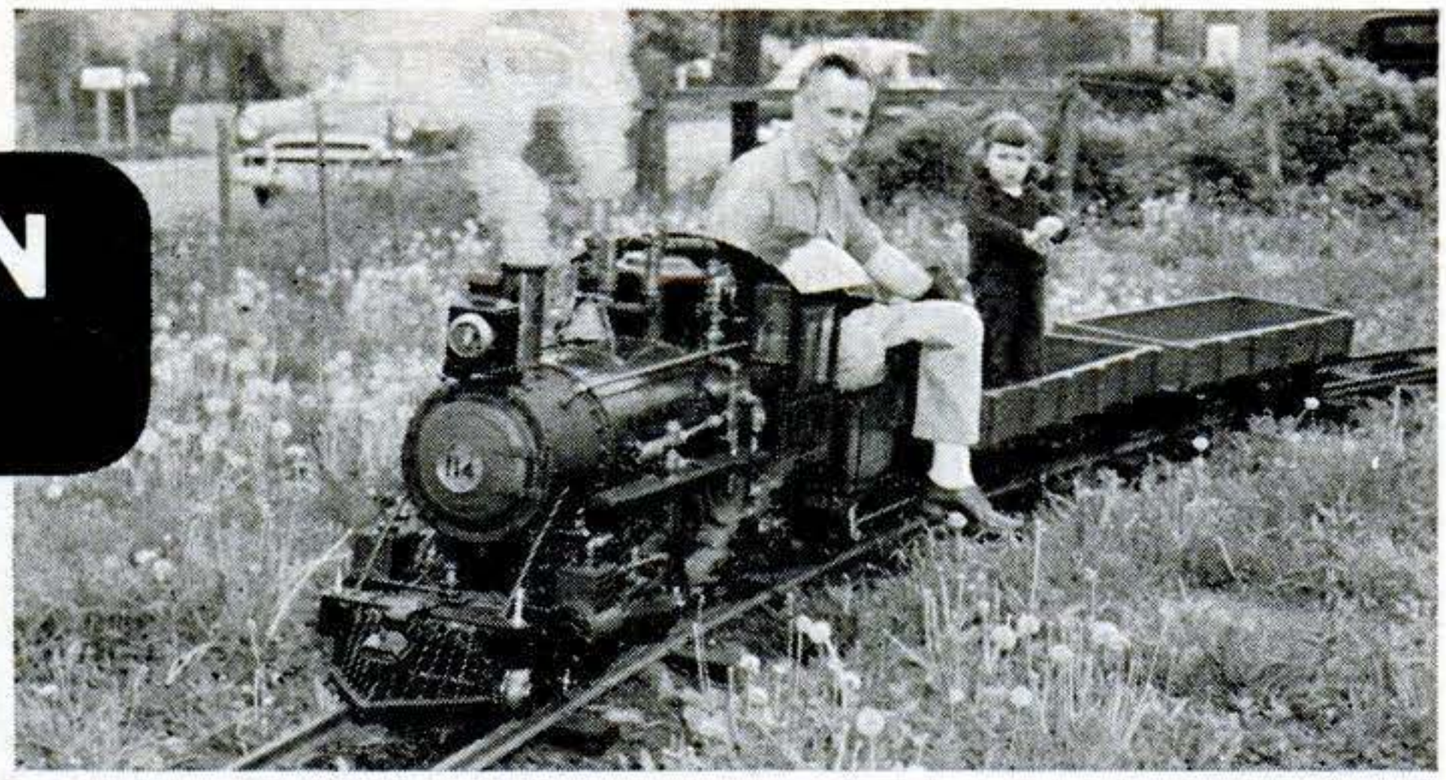
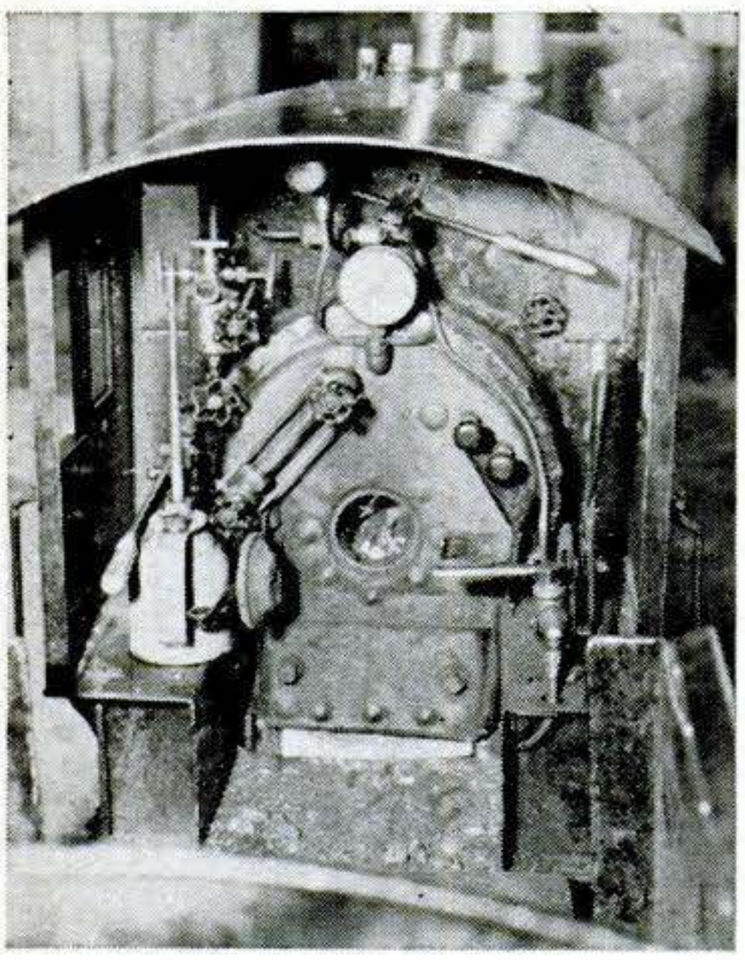
CRAFTSMEN AT WORK

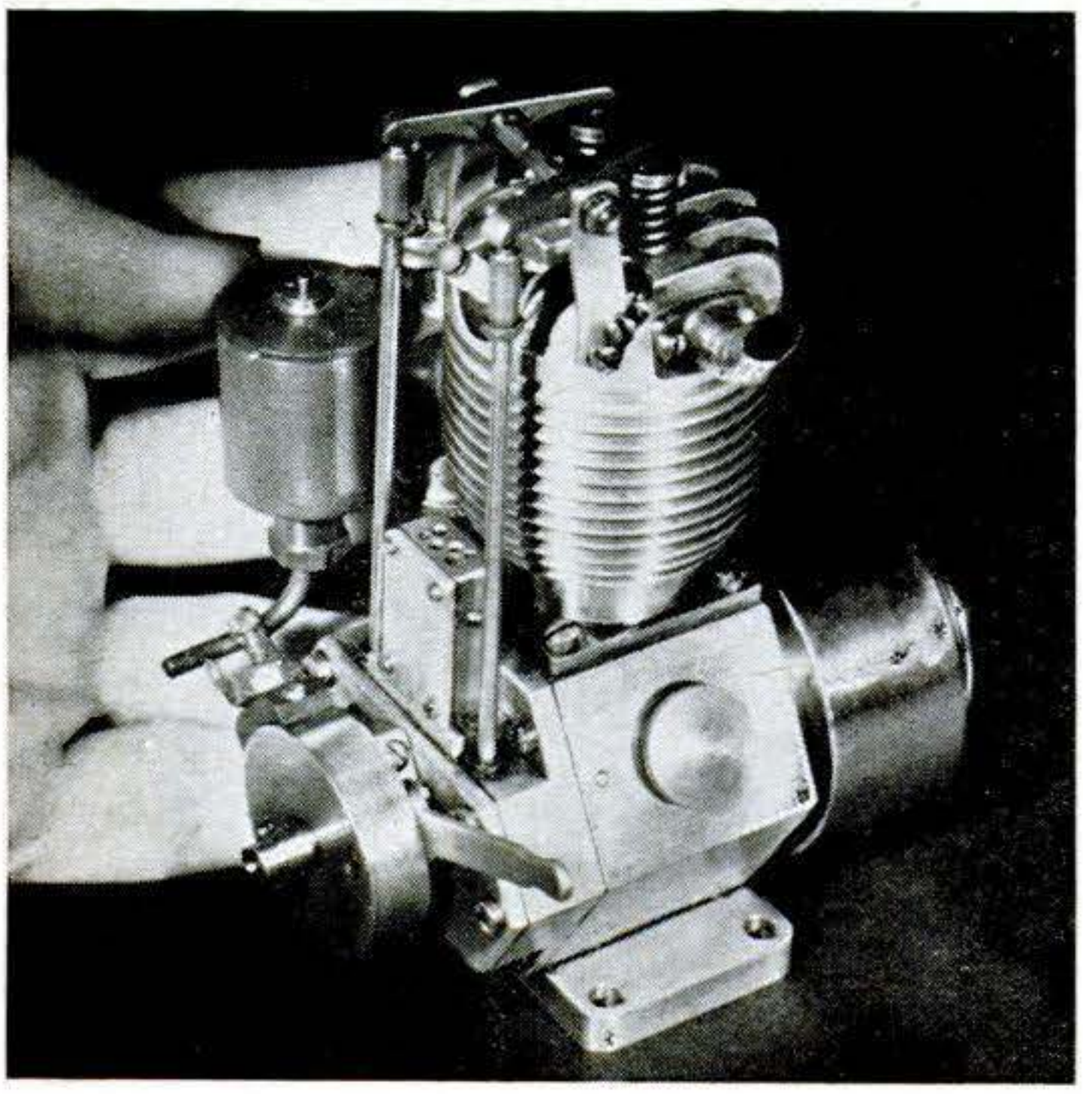


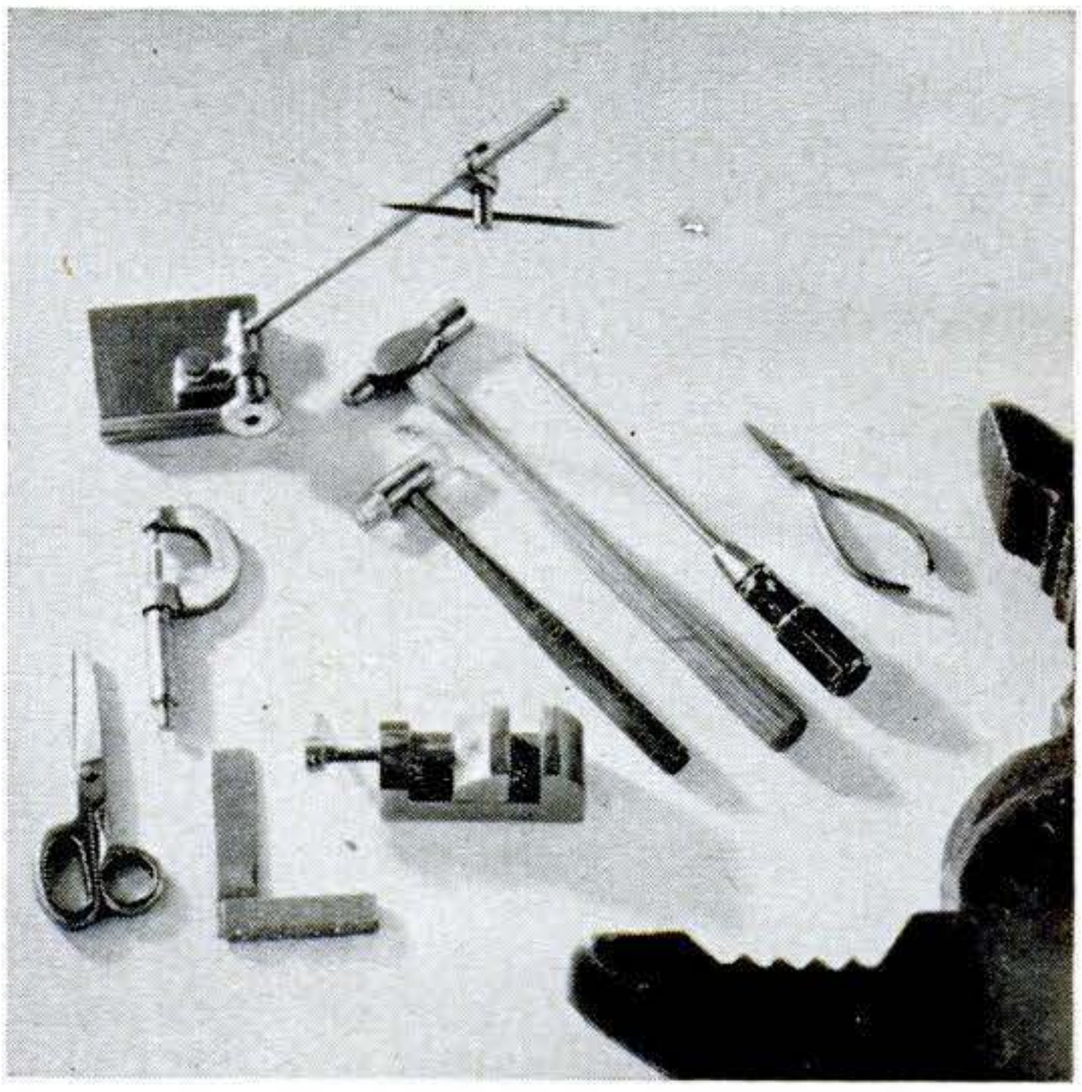


Shorts Operate Short-Line Railroad. Brothers Emmet and Owen Short, of Luray, Va., built and operate this model railway. They have put in more than 2,000 hours of work on the 2″-to-1′ scale model of an Atlantic (2-4-2) locomotive and 1,000′ of track. The locomotive is 7½′ long, 31″ tall, and weighs 700 lb. It's a coal burner and generates 70 lb. pressure. When Owen is not helping his brother with their wrecking business, he is a foreman at the American Viscose Corp. plant at Front Royal, Va. Photo above shows Owen with a small passenger, Mary Silvers. At left is a view of the interior of the cab. The line gets a big play from youngsters on Sundays.

Model Four-Cycle Engine. This job (below) resulted when Howard McEntee of Ridgewood, N. J., picked up two ball bearings and a length of dural hex stock. The latter looked so good for a crankcase that he set to work. He made the cylinder of seamless steel tubing with a shrunk-on aluminum sleeve having cooling fins. The head has steel inserts for the ⅜″-diameter valves. There is a separate cam and gear for each valve. The carburetor has a float soldered up from .001″ shim brass. Bore and stroke are ⅞″.

Miniature Tools Fit in Aspirin Box. The smallest of the nine tiny tools below is the machinist's vise—9/16″ long. The longest is the ball-pein hammer—1⅞″. John R. Fox of Northport, N. Y., made the scale models of stainless steel. All of them work like full-size tools. The scissors cut and the surface gauge has a pin and spring in back of the tilting arm to maintain proper tension. The set fits in a small aspirin box. In the photo the tools are shown between the jaws of ordinary pliers.





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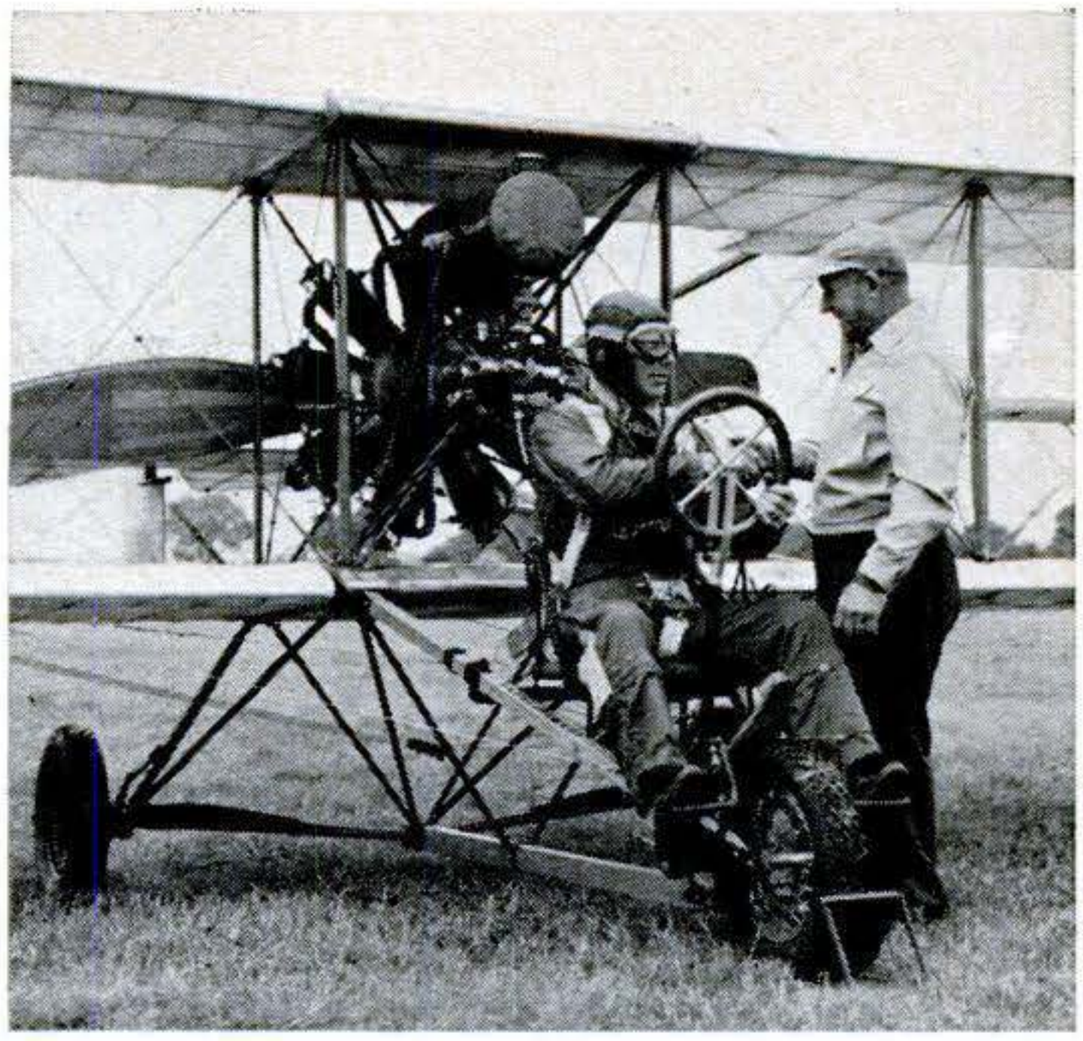
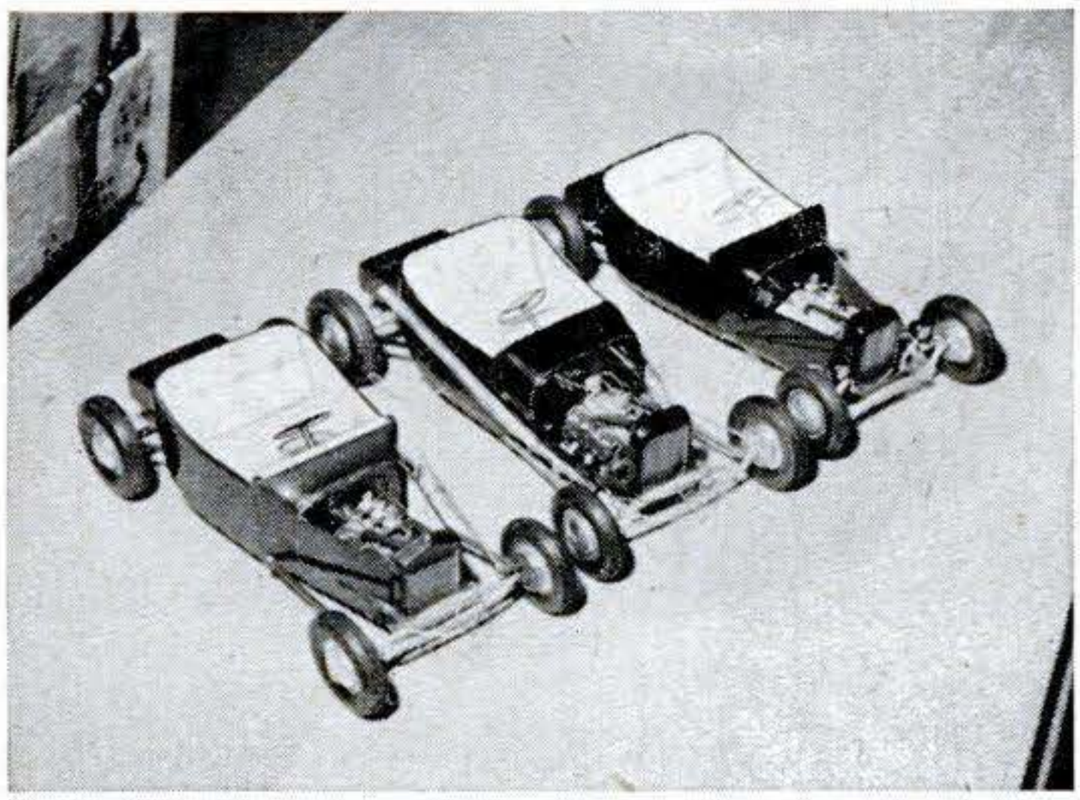


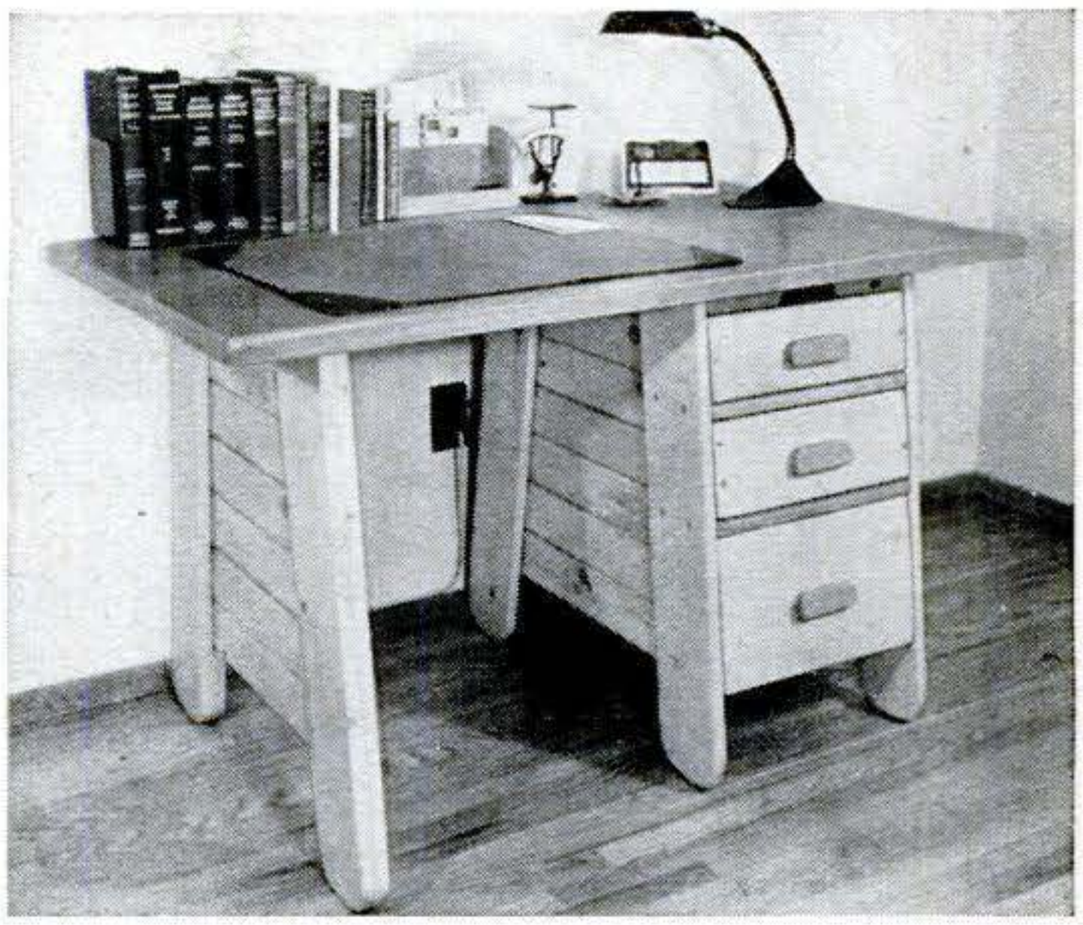
Builds Flying Machine. That's what airplanes were called in 1914, when the original of this one was stunting at county fairs. Bert Dudek of Cleveland built this full-scale flying replica of a 1914 biplane. He even put in the same kind of power plant—an 80-hp. Gnome rotary engine, which has cylinders that spin with the prop while the crankshaft stands still. Figures on the plane include: wing span, 21′; length, 18′; height, 7½′; weight, 890 lb. It burns six gallons of gas an hour, has a top speed of more than 80 m.p.h., and cruises at 65 m.p.h. The photo above shows Dudek (standing) with the pilot who tested the plane.

Carnival for Dolls. Movement, lights, music and the excitement of a real street fair are all built into this miniature carnival. Thomas Hornsby, Jr., Streator, Ill., started work on it in 1945, and now plans to add more rides, an arena, and a side show to the setup. The rides are powered by separate motors and are operated through a timer that turns them on and off automatically.

Model Hot Rods Rival Originals. Al Jiminez doesn't herd a hot iron himself, but he does the next best thing—builds models of the rigs tooled by his hop-up friends. Working on the kitchen table of his home in San Juan Capistrano, Calif., he has turned out a model fleet (below) of Ford chopped-jobs. The tiny engines, carved from hardwood, carry from one to four pots—like the multi-carburetored rigs that clip off more than 150 m.p.h. on the dry lakes.



Desk Built of Flooring. R. P. Schoemaker of Edmonton, Canada, got his idea for this desk from a similar one built of shiplap (PS, Oct. '50, p. 186). He used common flooring, top-grade shelving, 1¼″ window-stop strips (for trim) and ¾″ plywood (for the top). Total cost: less than $10, including $4.10 for the plywood. The bottom drawer holds a portable typewriter.



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How to Thaw Frozen Pipes

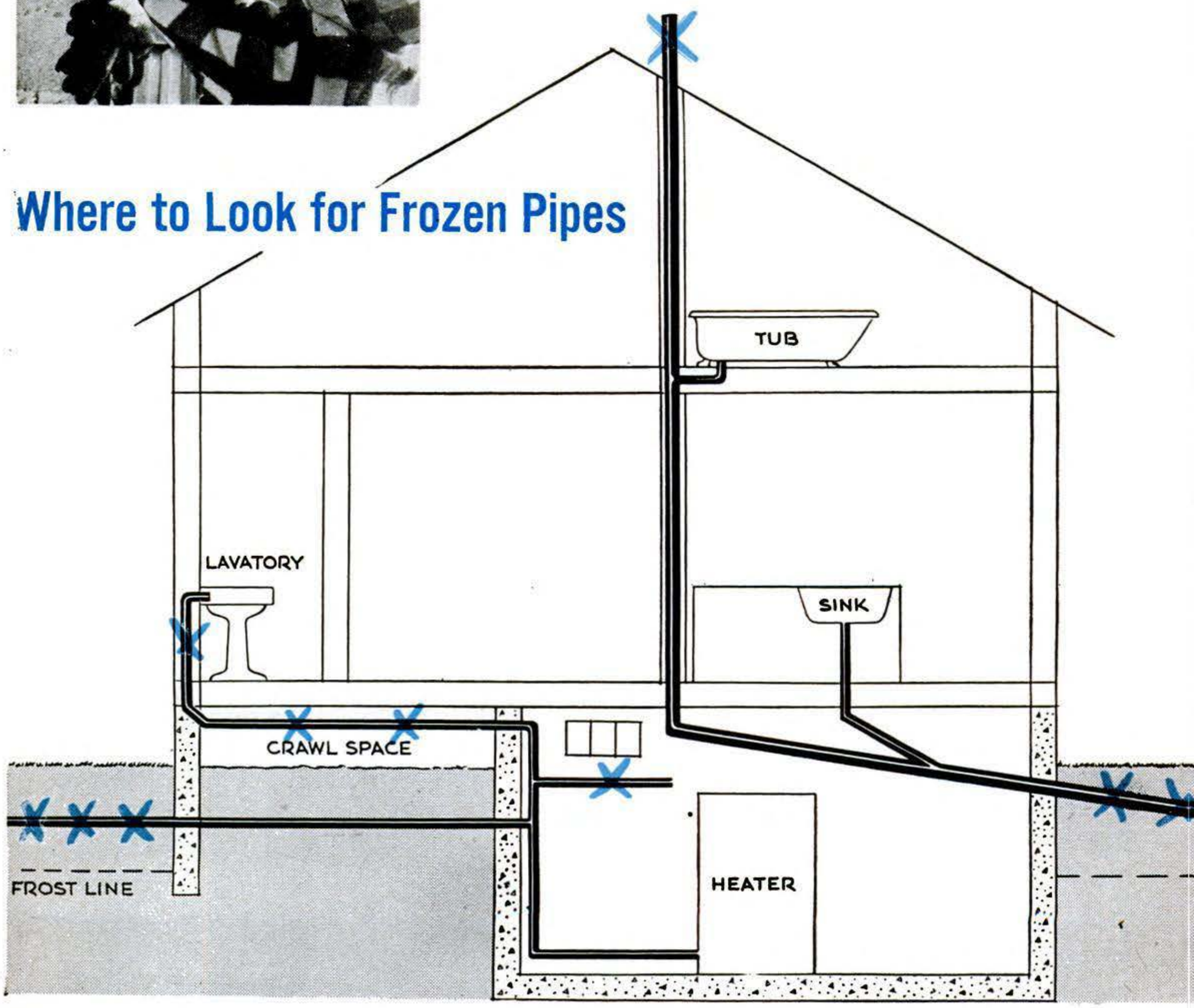
There are cold nights ahead. Here's what to do if Jack Frost breathes a bit too hard on the water pipes or drains in your home.

FROZEN pipes will give many homeowners a chilly awakening this winter. If it happens to you, take these steps to thaw them out:

1. Warm up the house if possible, especially the area where freezing has occurred. Pipes thawed in a freezing temperature would only freeze again. But do not fire up a heater if its own pipes are frozen.

2. Locate the frozen lines. Turning on

Where to Look for Frozen Pipes



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the faucets will show which pipes are closed. Feeling the pipe with your bare hand may help you find the sections where ice has formed. A crack is a sure sign.

3. Apply heat. If it's a water pipe, work toward the supply, leaving a faucet open to show when flow starts. On a waste pipe, work upward from the bottom so the waste will drain away.

4. Replace any cracked pipes or make temporary repairs, perhaps by wrapping tightly with friction tape. If a section of pipe has to be removed, a piece of garden hose might be installed in the gap temporarily.

5. Take steps to prevent another freeze-up.

What heat source to use will depend on what you have available and where the freeze-up is—in an accessible spot within the house, inside the walls or underground outside.

Any of the common heat sources suggested in the drawings on this page could be used for accessible freeze-ups. Infrared bulbs or an electric heater may also give results on walled-in pipes. Another sketch, on the next page, illustrates a practical hot-water procedure for thawing underground pipes. This, however, would be a messy job in the case of a waste pipe.

Ice in an underground pipe, incidentally, is proof that the pipe hasn't been placed below the frost line for the neighborhood. To prevent future freeze-ups, plan to place it lower when spring arrives.

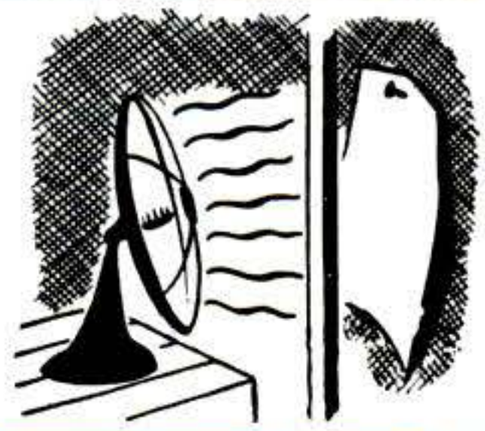
Besides the supply and waste pipes, the vent pipe that extends through the roof sometimes closes up at times of extreme cold, perhaps from a combination of ice and snow. Your bathroom and kitchen fixtures then may not drain properly. A kettle of hot water carried to the roof and poured down the vent will correct this.

Electricity thaws pipes fast. But you need lots of juice. If you have or can borrow an arc welder, that's the ticket. A big one, of 300-amp. rating or more, will make short work even of frozen underground lines. In overcoming the electrical resistance of the pipe, the heavy current heats it and melts the ice.

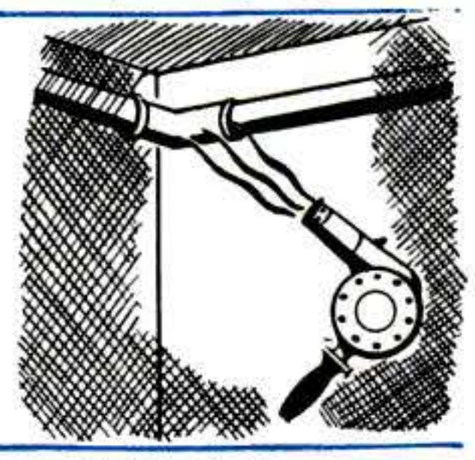
A light-duty transformer welder does not have the power to handle big freeze-ups, but can make short work of thawing small ice blocks, frozen valves, and sections of copper pipe. For this kind of local thawing, it is usually best to connect the ground lead to one side of the frozen section, put a carbon

Common Heat Sources for Thawing Pipes

BOILING WATER. Cloth wrapped around the pipe will keep water in contact with pipe.



ELECTRIC HEATER. Rest it on a firm support a few inches from the pipe. A sheet of aluminum foil or shiny tin placed on opposite side of pipe will reflect heat back.



HAIR DRIER. This might do the trick if pipe is located high overhead or in a spot where it would be dangerous to use an open flame.

INFRARED BULBS. Reflector type that some motorists use to warm engines would do this job, too. If pipe is hidden in wall, they may send radiant heat through wall.

NEWSPAPER TORCH. Tightly twisted paper set afire could be used. Be careful of flame.

BLOWTORCH. This will give fast heat, but remember its flame is a serious fire hazard.

SOLDERING IRON. Heat it up and tie against pipe. An electric household iron could be used by connecting to extension cord.

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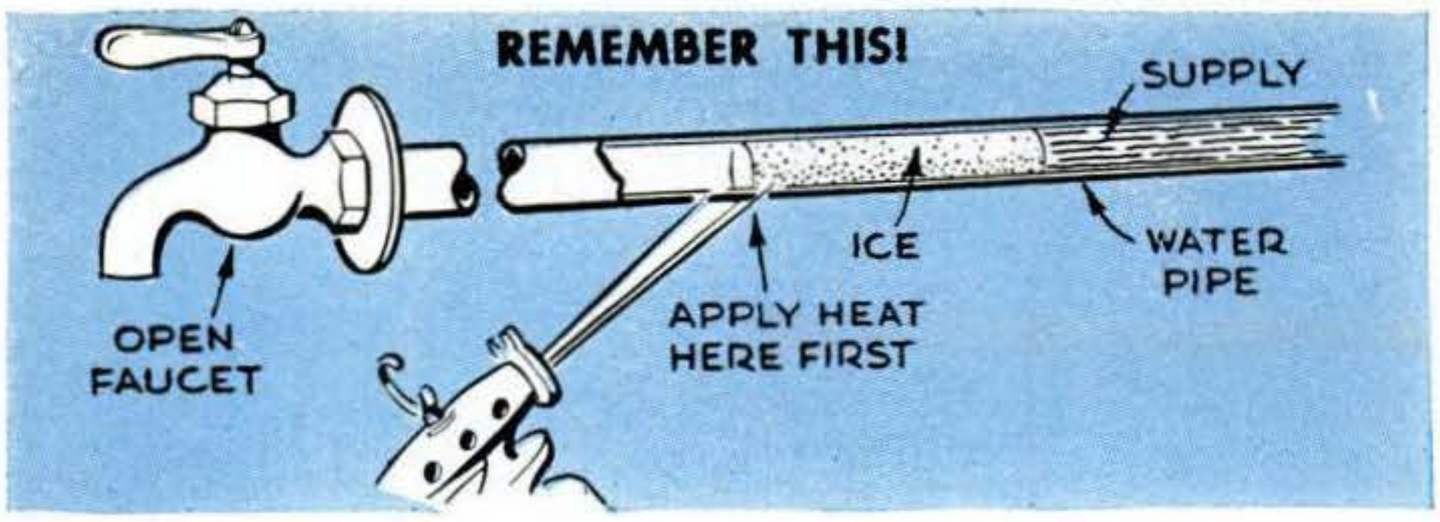


HERE'S THE FIRST RULE for thawing all frozen water pipes. Open a faucet at end of pipe and work gradually away from it as you apply heat. *Never apply heat to the middle of a frozen area.* Trapped water may flash into steam and burst an otherwise good pipe.

in the electrode holder, and hold the carbon tip on the other side of the freeze-up, using the low-voltage tap. The carbon will glow white hot, but there is no danger of fire elsewhere.

If you don't know the exact location of the ice block, you can clamp both leads along a short length of suspected line. The longer the distance, the more time it will take to heat the pipe between. However, if the ice has not melted in 30 or 45 minutes, give the welder a few minutes rest. Use only the lowest voltage. Never overload the welder so much that the case becomes too hot for your hand.

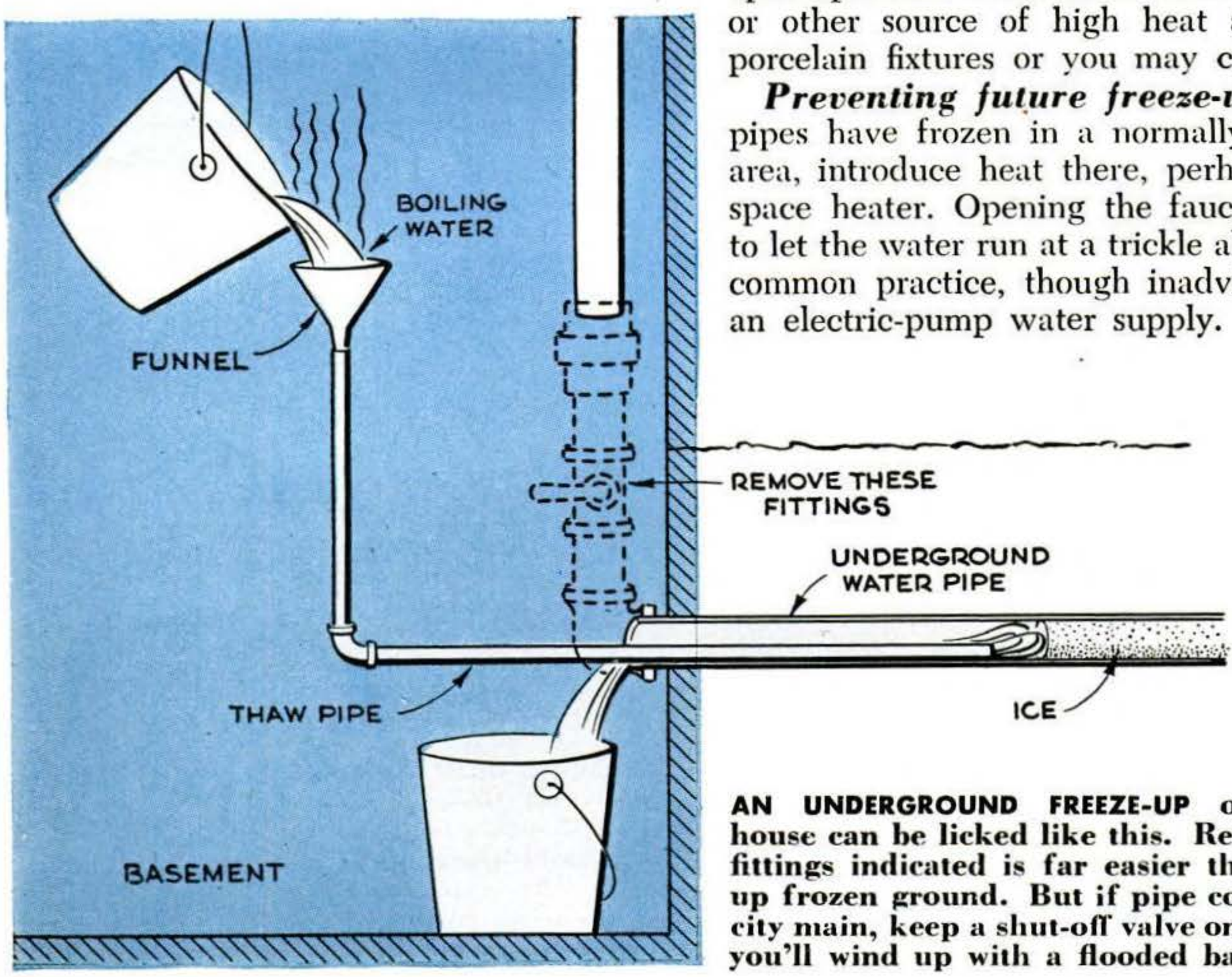
If the frozen pipe has burst, see that the main shut-off valve is working before you begin applying heat or you'll have a flood on your hands when the flow starts. Unless the damage is extensive, leave the valve open until you have broken up the block. The water pressure will help. If the freeze-up is accessible, catch the drippings in a pail.

Whether a frozen pipe will burst depends largely on its type. Brass pipe can withstand a pressure of 1,000 pounds per square inch. Soft copper tubing has been known to freeze a half-dozen times before finally letting go. Galvanized iron pipe and hard copper tubing on the other hand usually burst on the first freezing, although they too may not be damaged if the temperature drops only a couple of degrees below freezing and ice formation is limited.

Caustic chemicals sold for opening up clogged waste pipes are sometimes used for thawing, since they generate much heat. But be careful that they do not remain in the pipes or fixtures for any length of time.

Pouring steaming water into bathroom or kitchen plumbing fixtures may also help open up frozen waste lines. But keep a torch or other source of high heat away from porcelain fixtures or you may crack them.

Preventing future freeze-ups. If the pipes have frozen in a normally unheated area, introduce heat there, perhaps with a space heater. Opening the faucets slightly to let the water run at a trickle all night is a common practice, though inadvisable with an electric-pump water supply.



AN UNDERGROUND FREEZE-UP outside the house can be licked like this. Removing the fittings indicated is far easier than digging up frozen ground. But if pipe connects to a city main, keep a shut-off valve on the line or you'll wind up with a flooded basement.

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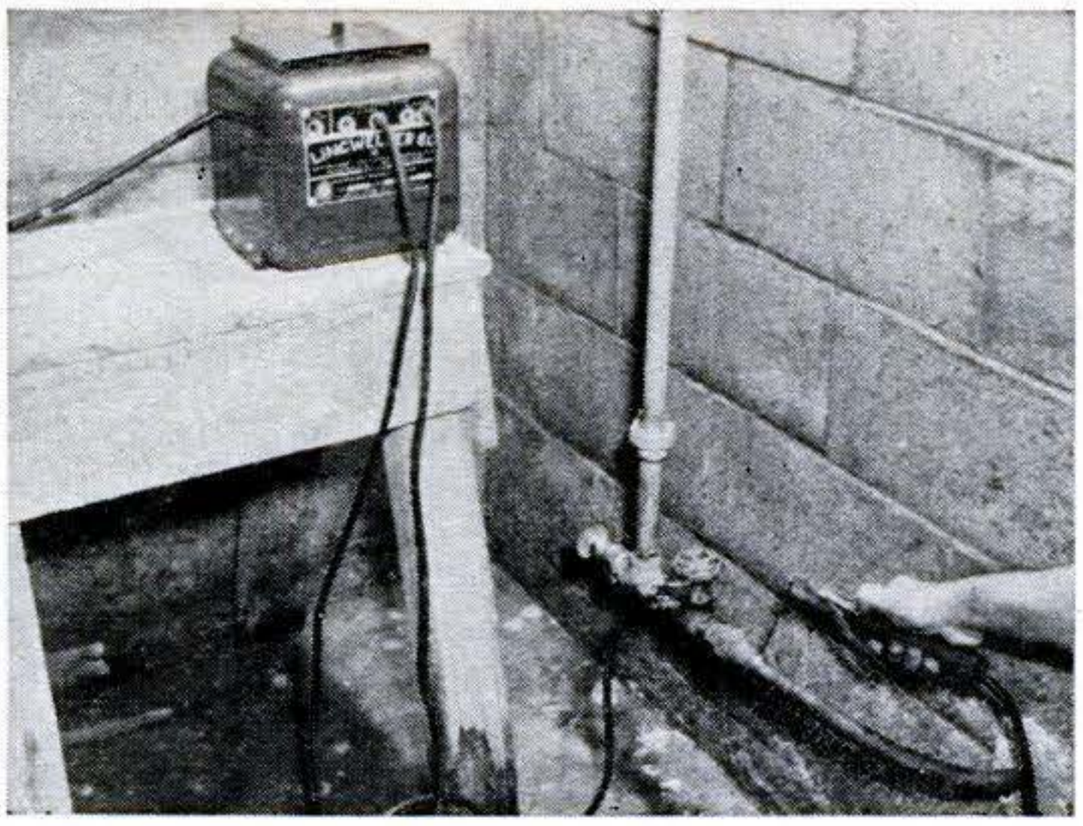
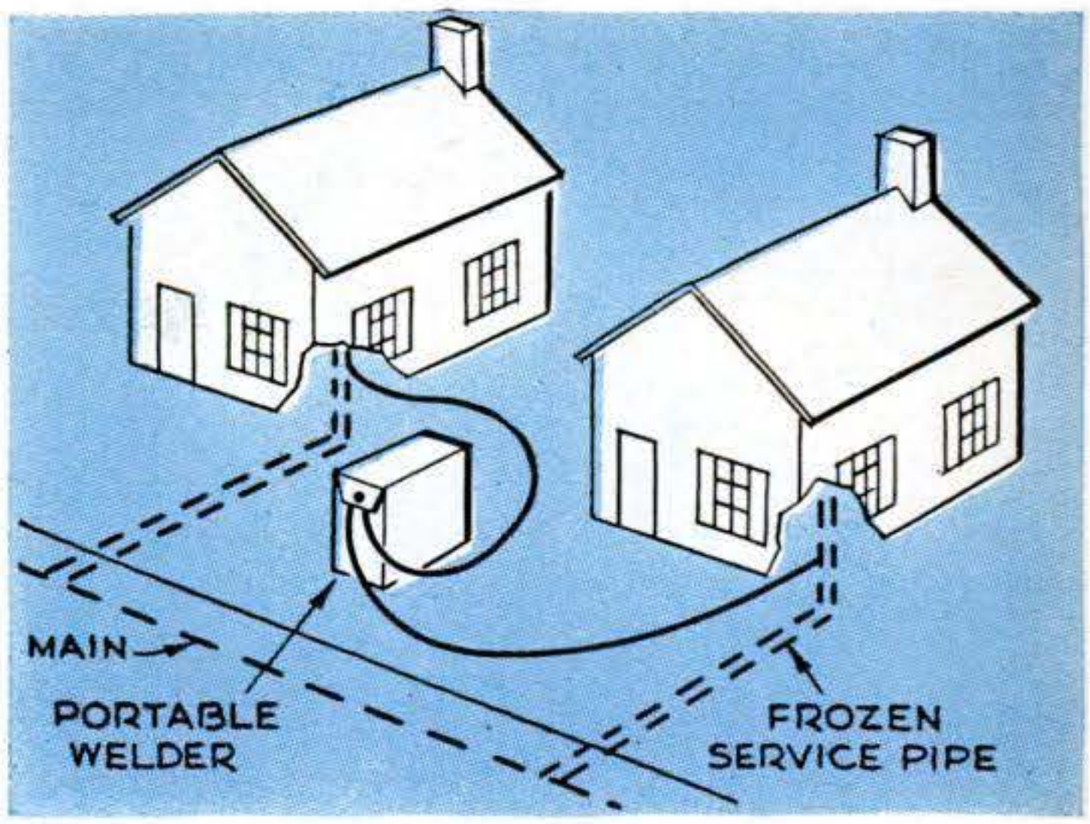


WELDER THAWS PIPES QUICKLY. A home-size arc welder is just the thing for spot thawing. In this case, current from the four-volt tap of a Linewelder 60 is being used. The ground clip was attached on one side of the frozen valve, the carbon tip touched to the other.

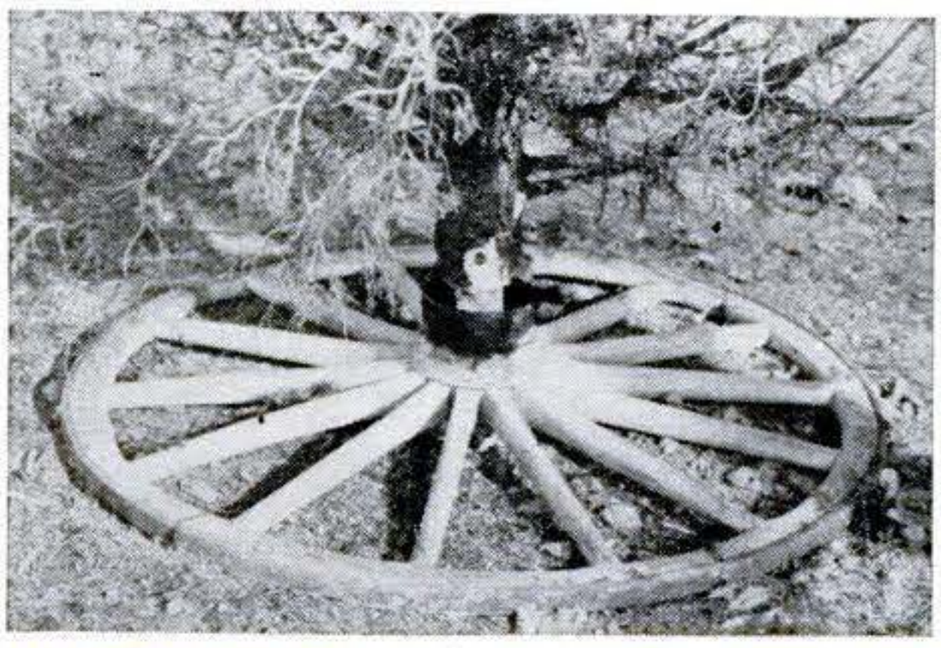


BIG THAWING JOBS call for a 300-ampere or larger welding generator driven by a gas engine. Here's how such an outfit is used to thaw two frozen pipes simultaneously. The rheostat must be set for minimum voltage, the current control for maximum amperage. But do not let generator exceed its rated amperage, and watch for overheating to prevent burning it out. If welder heats up, turn it off and let cool. Then use intermittently.

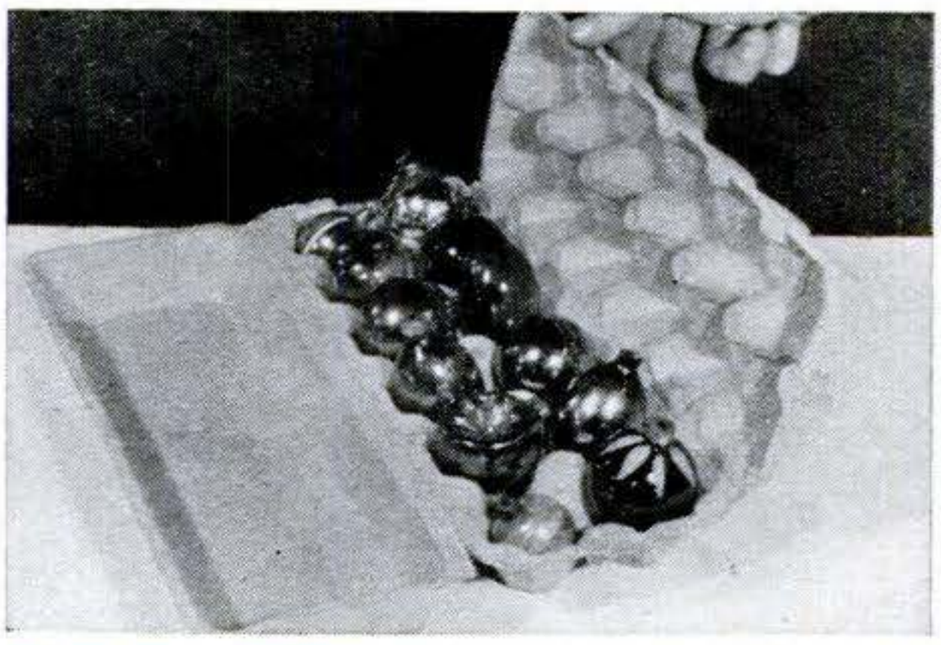
If freezing is likely to occur overnight in plumbing traps or floor drains located in unheated areas, pour in kerosene or automobile antifreeze mixture. Use two quarts in a toilet bowl, one or two pints in other fixtures.

Outside pipes that are exposed or too near the surface can be protected by covering them with dry shavings, excelsior, sawdust, leaves, salt hay, chopped straw, pea or nut coal, mineral wool, or industrial slag. If the run is short, one or two wooden boxes, set over the pipe or just on the ground above the pipe and covered with one of these materials, will be effective. END

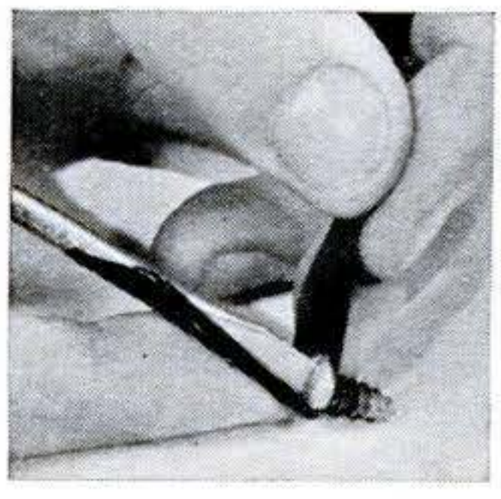
DO IT THE EASY WAY



WAGON WHEEL makes sturdy stand for outdoor Christmas tree. It provides a broad base that won't tip. Wheelbarrow wheel will hold smaller tree.



CHRISTMAS-TREE ORNAMENTS of small size can be stored safely, without extra wrapping, in pressed-fiber egg cartons. Rubber bands will hold the boxes shut.



STARTING SCREWS or bolts in hard-to-reach spots can be aggravating. But if you fasten the screw or bolt to the end of your screwdriver with electrical tape, it simplifies the job.

A MARKING PENCIL tucked into a hole in the saw handle is always at hand when work is to be marked for cutting. Drill hole that will be a light push fit for a pencil stub.

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Your Voice Powers These Telephones

It generates the electricity they need to carry sound over miles of wire.

SOUND-POWERED telephones give you honest-to-goodness telephone service from room to room or over miles of wire at an operating cost of exactly nothing.

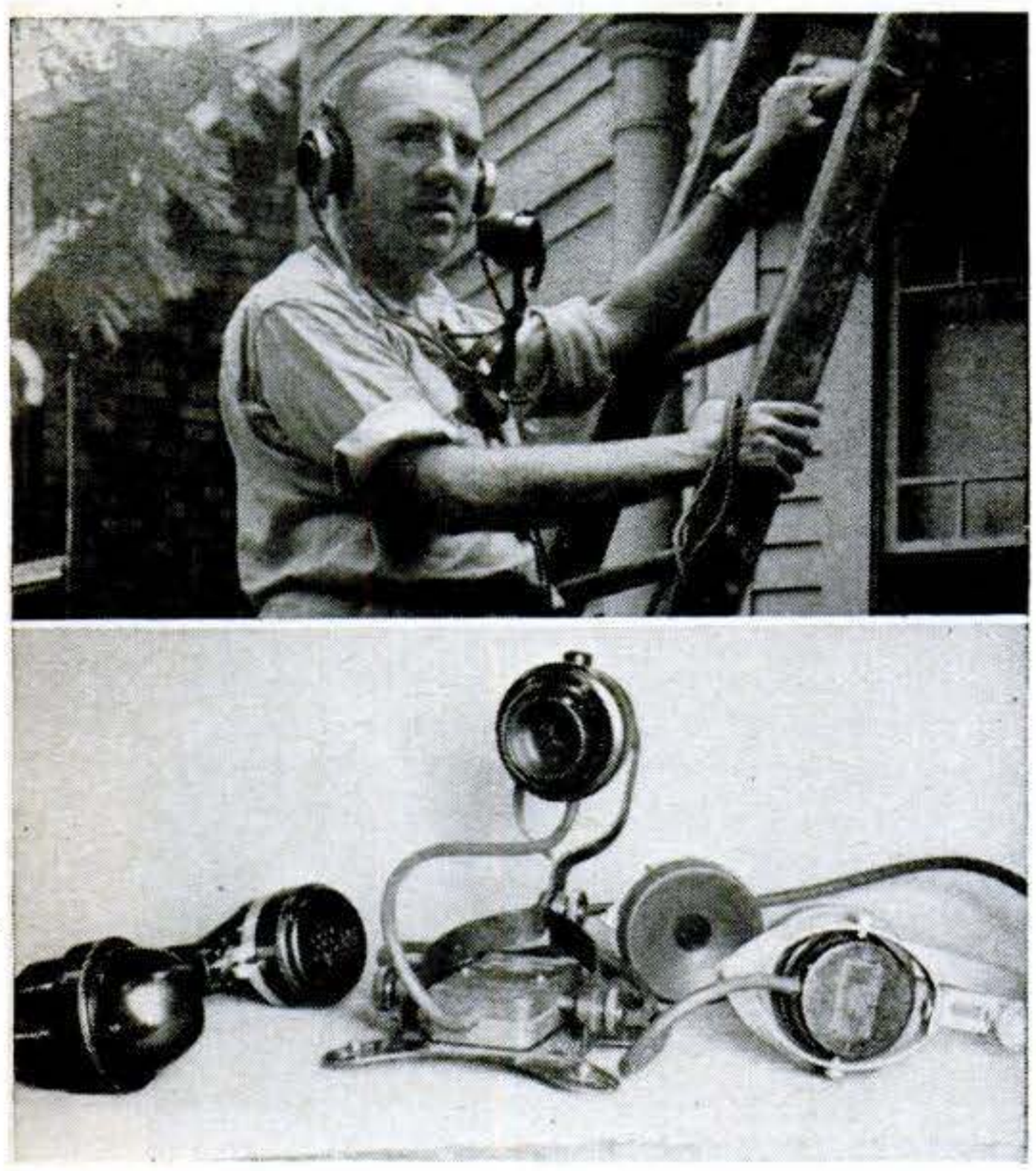
These amazing phones were widely used in the war and a lot of them found their way into surplus markets. Many are still there—waiting for you to pick them up for a song and put them to work.

With them, your wife will be able to call you out of the workshop when dinner is ready—and you'll have a chance to plead for a few minutes more. On a farm you will find them effective to the farthest outbuilding, even if it is miles away. They are ideal for taking inventory, orienting TV antennas and many similar jobs.

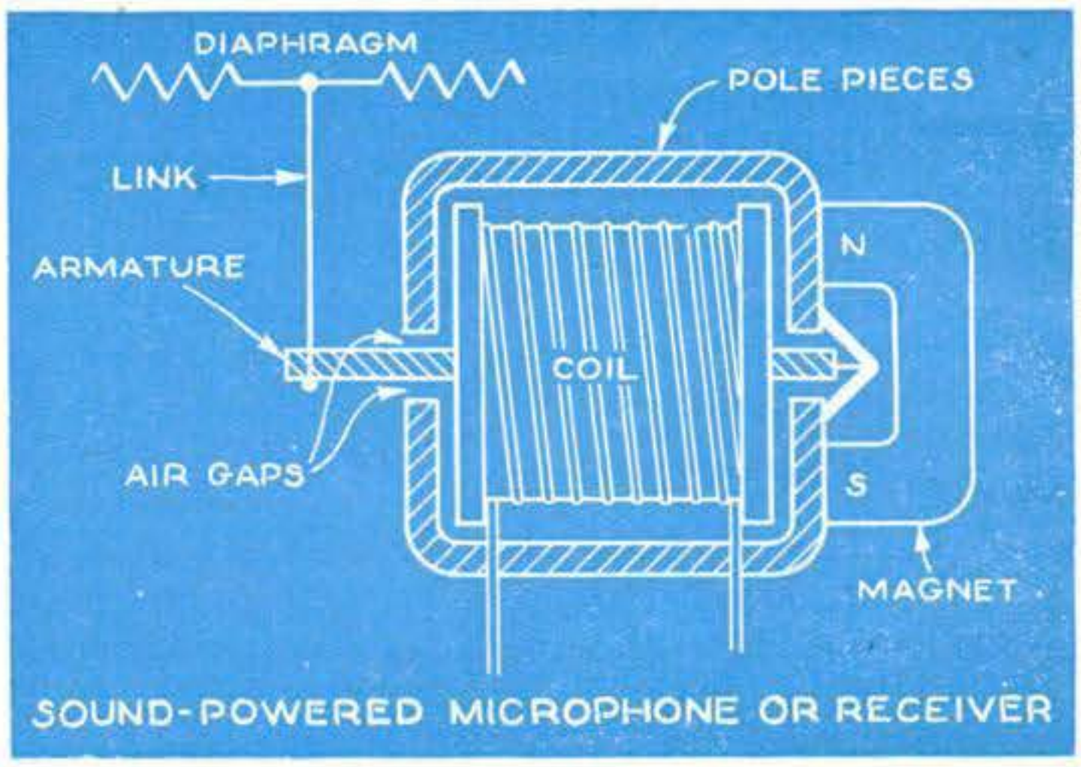
Ex-service phones are available in two main forms—those that were intended to be used as telephones, and those that were not. The former includes the ones pictured at the lower left and shown in use on this page. In the other group are large numbers of ordinary headphones that can easily be changed into regular telephone systems.

Most sound-powered phones use identical units for both microphone and receiver. The construction detailed in the sketch (below) is typical. It is also typical of the construction of millions of headsets.

Though practically any type of headphone can be used, differences in magnet



SURPLUS PHONES come in handsets (left) or head-and-chest sets. Priced from about $3 up, some have ringing generators and bells.



HOW THEY WORK: The armature vibrates when sound hits the diaphragm to which it is linked. Vibration generates electricity in the coil.

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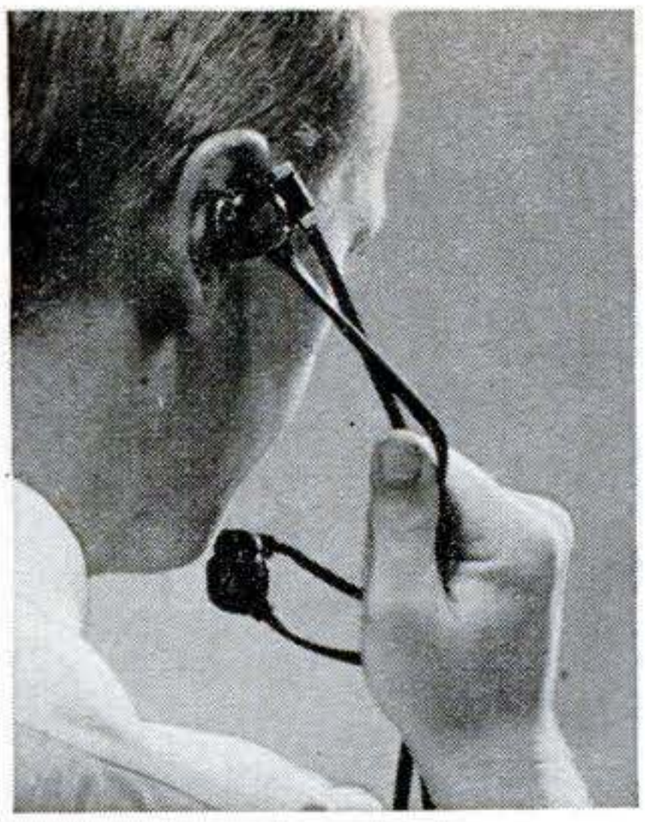
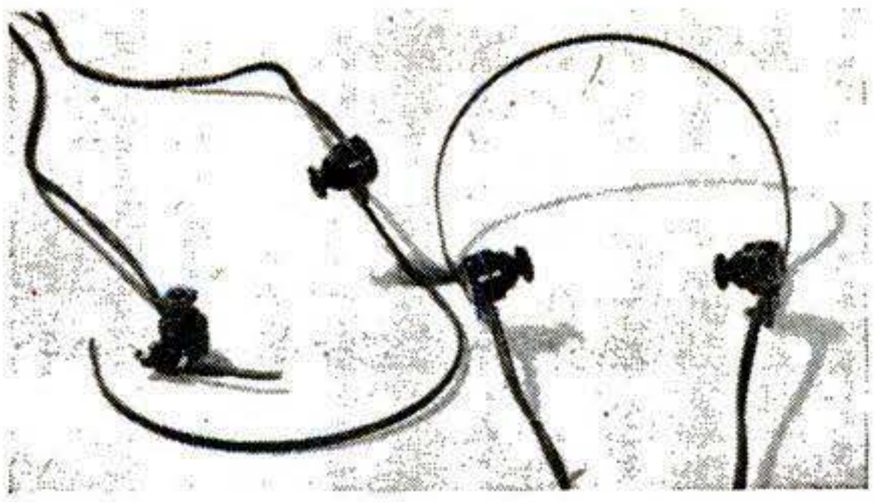
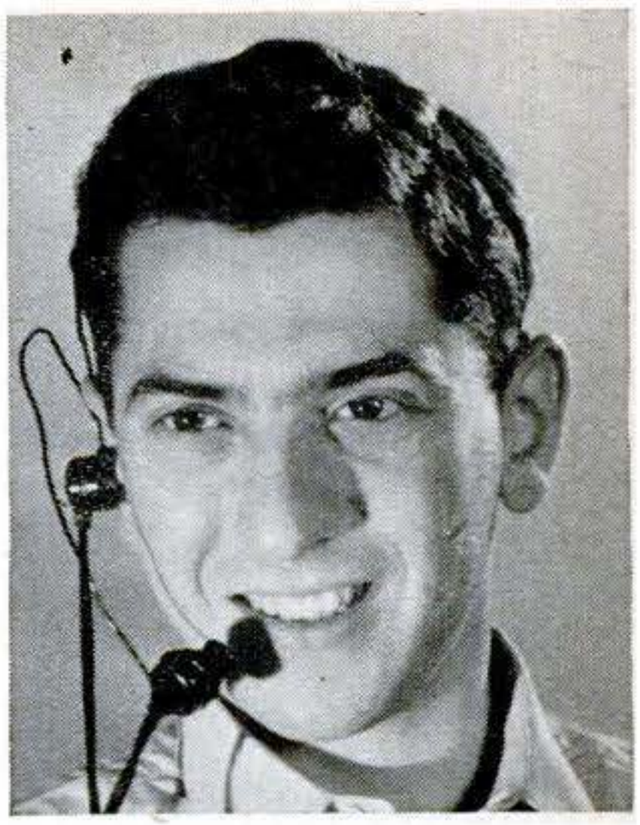






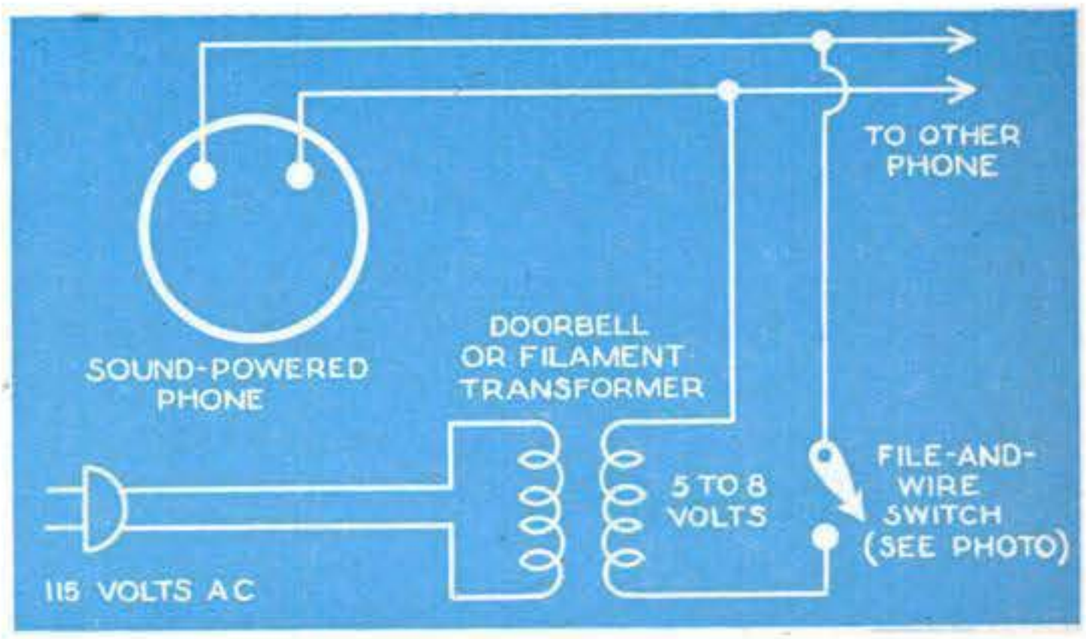
TWO SETS OF HS-30 MIDGET PHONES —for under $4—can easily be converted into two-way intercom. Bending headband turns one pair into handset (left). No-hand unit (right) is made with coat-hanger wire.

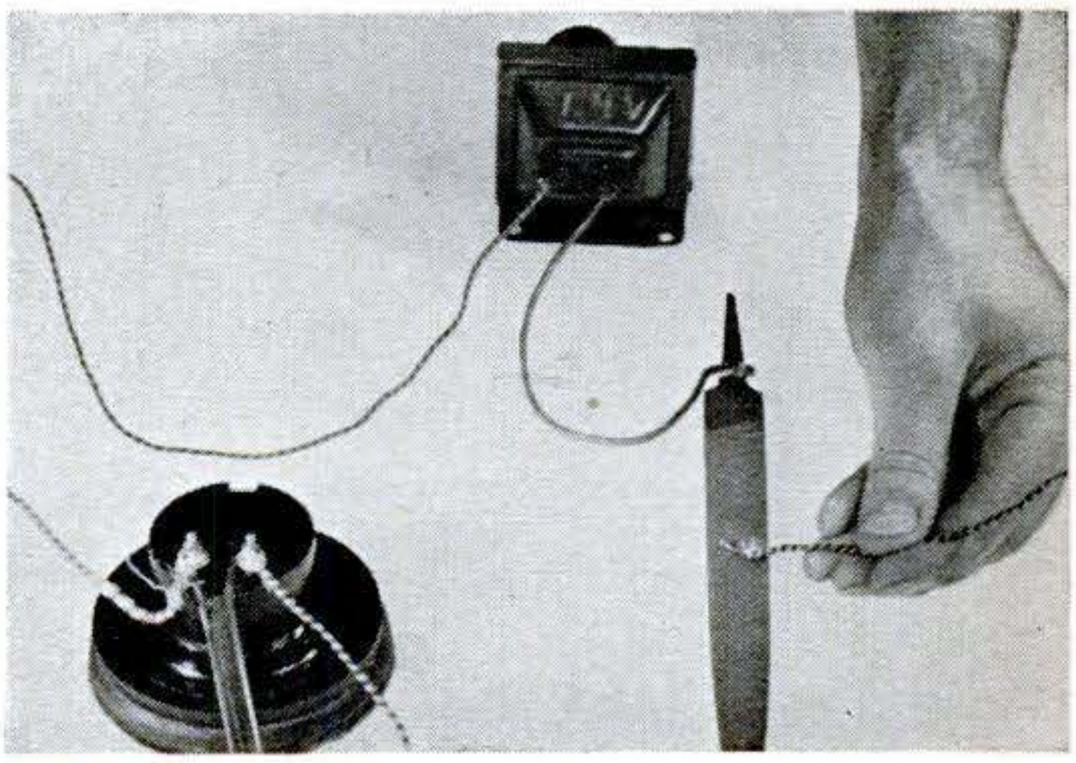
strength and armature balance make some much more suitable than others. Among the very best are the inexpensive surplus HS-30 midget phones pictured above. You can use either of the earpieces for listening or talking.

The bulky earmuff jobs below also work well. Discard the mike and other accessories and use one phone at each end of the line. In this setup each unit acts as both mike and receiver. When you buy phones, get identical units for all stations. Each phone has two wires or terminals that should be connected to corresponding wires or terminals on the other unit.

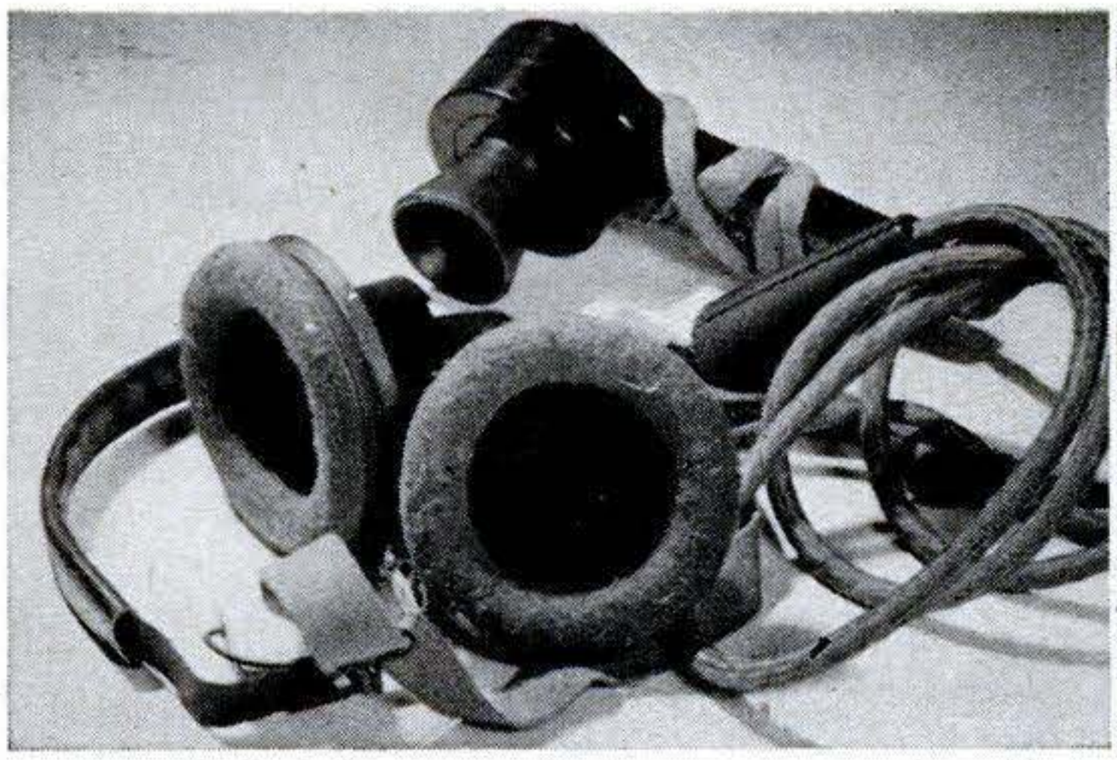
For short distances you can use any type of wire; for longer spans use No. 18 twisted pair.

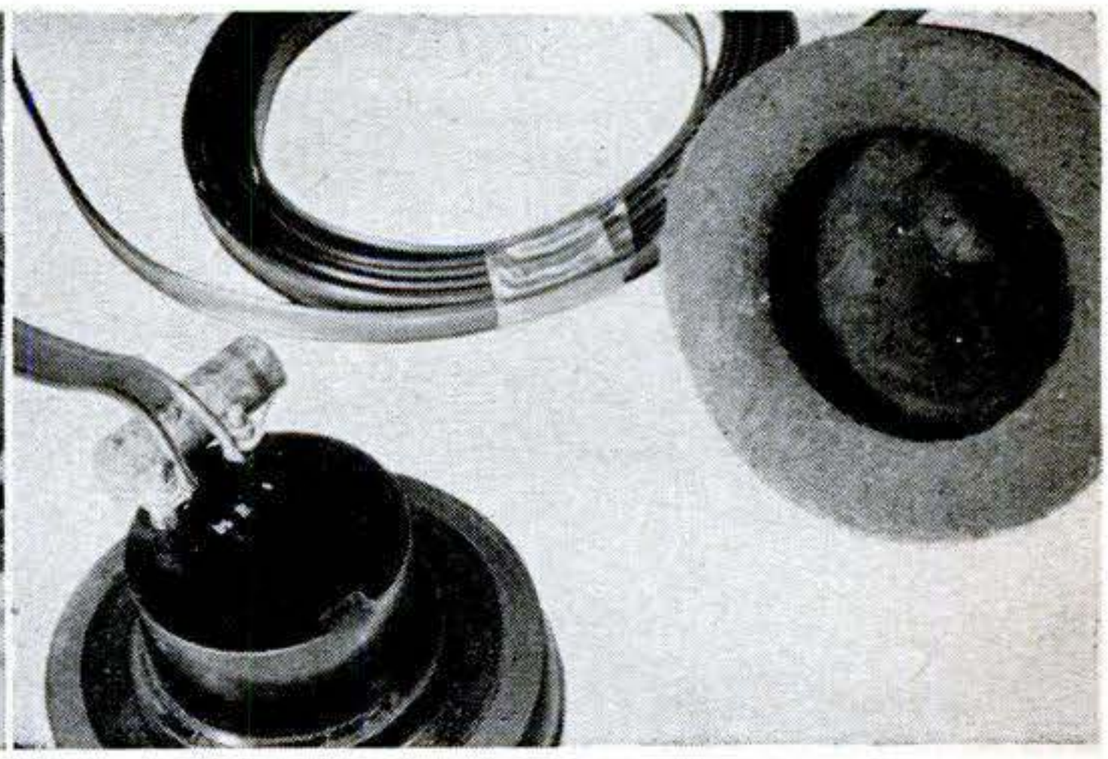
If you wish you can call the party at the other end of the line by whistling into your phone or banging on a steampipe. The sketch at the right shows a more positive paging method that can be used when both ends of the line are conveniently located near AC outlets.—*Howard G. McEntee, Ridgewood, N. J.*





PAGING SYSTEM uses filament or doorbell transformer and a crude switch. Bare wire dragged over file makes both phones click.





EARMUFF SET from tank intercom makes inexpensive telephone. Discard mike and disconnect both earpieces. Reconnect them through any length of two-conductor wire. Putting a .1-mfd. capacitor across the line may improve operation of the phones.

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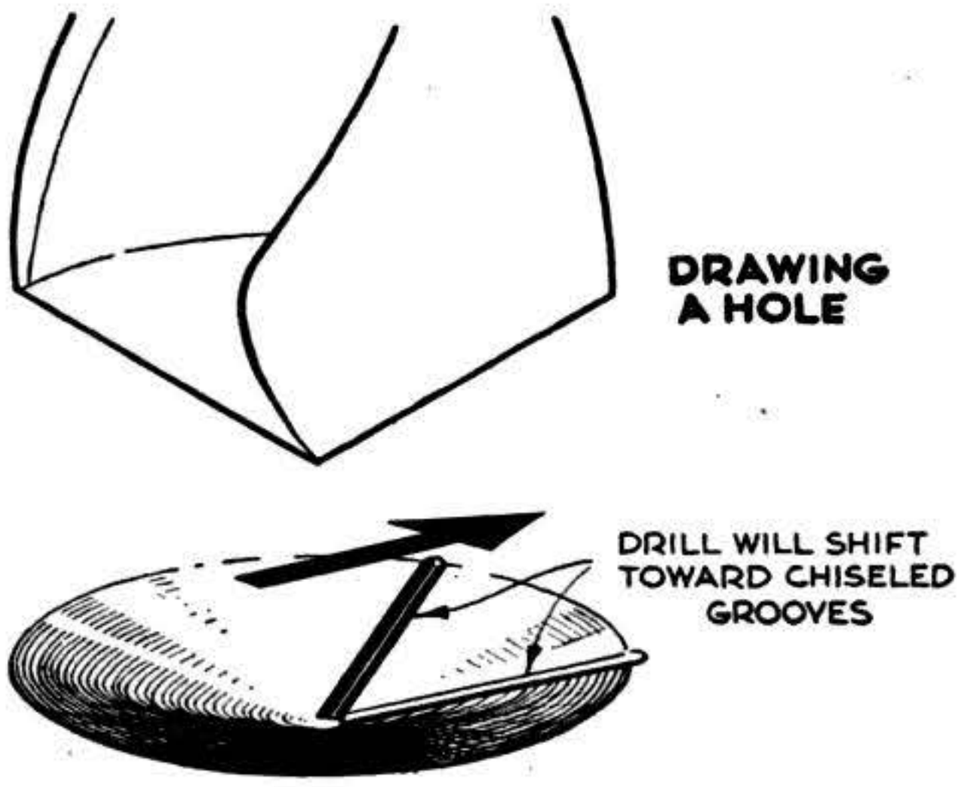
[Continued from page 224]

"Luckily you've drilled only a dimple. Move it over by making a heavy center-punch mark on the side you want the drill to go."

"Can I? Usually I drill 'em wrong and file the hole oval afterward."

Jim laughed. "Once you've drilled to full diameter you've got to. But so long as you



haven't, even big drills can be drawn over. Just chisel a groove or two in the dimple."

"And the drill follows the line of least resistance, huh? Thanks. Next time I'll drill through both parts at once."

"That's the stuff. Ever notice how easily a big drill will get off the punch mark? The way to beat that is to drill a pilot hole, same size as the drill web."

What Breaks Tiny Drills?

Jim had been removing a broken drill from a small drill press on another bench.

"Gee," said Larry. "I made you break a drill by keeping you from your big press."

Jim laughed. "Oh, no. I wouldn't use this 58 drill in that press. What broke it was carelessness in starting on a curved surface."

"You mean this little press is better?"

"For drills from No. 50 down, yes. Know what breaks those babies most often?"

"Pushing them too hard."

"No, running them too slowly. What happens is you feed them faster than they can cut. Fact is, a speed of 1,000 r.p.m., which is reasonable for a ⅜" high-speed drill working in cast iron, is way too low for a 1/16" drill. It should run 6,000."

"I don't see why," Larry confessed.

"Well, what counts is how fast the lips turn past the work. Machinists call that surface feet per minute—SFM. The corner of the lip on a ⅜" drill travels over an inch every revolution. On a 1/16" drill it goes only about 3/16". It has to spin a lot faster to travel at the same SFM. To do 100 SFM, a No. 60 must run about 10,000 r.p.m."

"My drill press won't do that."

"Neither will mine. That's why I built this sensitive drill. It runs up to 15,000. But you can use the fastest belt step on yours. Just remember what the little drills are up against, and feed easily."

"How about average sizes like ⅛"?"

"Well, SFM varies for different materials, from as low as 30 for stainless steel to 300 for wood, aluminum and magnesium. Suppose you want a ¼" hole in dural. At 300 SFM, the drill has to run 4,500 r.p.m. Isn't that your third pulley step?"

"Guess so. I always use the second step."

"And you'll get the same ¼" hole, too," Jim confided. "Those ideal speeds are figured for production runs, where seconds count. Just remember to run the big fellows slow, and the tiny ones fast."

Resharpening the Little Ones

Larry went to the big press. "This oil seems to help a lot."

"It's soluble cutting oil, not lubricating oil. I use it for drilling all metals except cast iron and brass. Those are drilled dry."

"I'll get some." Larry glanced at Jim. "Say, you're not repointing a No. 58?"

"Got to. It's the only one I have." Jim touched the jagged end lightly to the grinding wheel. "I grind it off square first, then I do the pointing by hand."

He held the drill, chucked in a pin vise, upright against the bench edge. With the India stick slanting slightly upward, and one face of it tilted to form the 59° lip angle, he stoned one side and then the other. Then he examined it through a magnifying glass and twisted it slowly into a cake of soap. A chip spiraled from one side.

Spring-Back Spells Trouble

"The other lip isn't doing much. See the slow chip?" He applied the stone again, until the drill threw up equal spirals.

"I'd use a new drill for a critical job, but this one's okay for most," Jim announced, refilling his pipe.

The evening wore on. Larry finished running the holes in the porch table, and switched to a ¼" drill for the bicycle carrier.

The stock was light, and he clamped the

[Continued on page 250]

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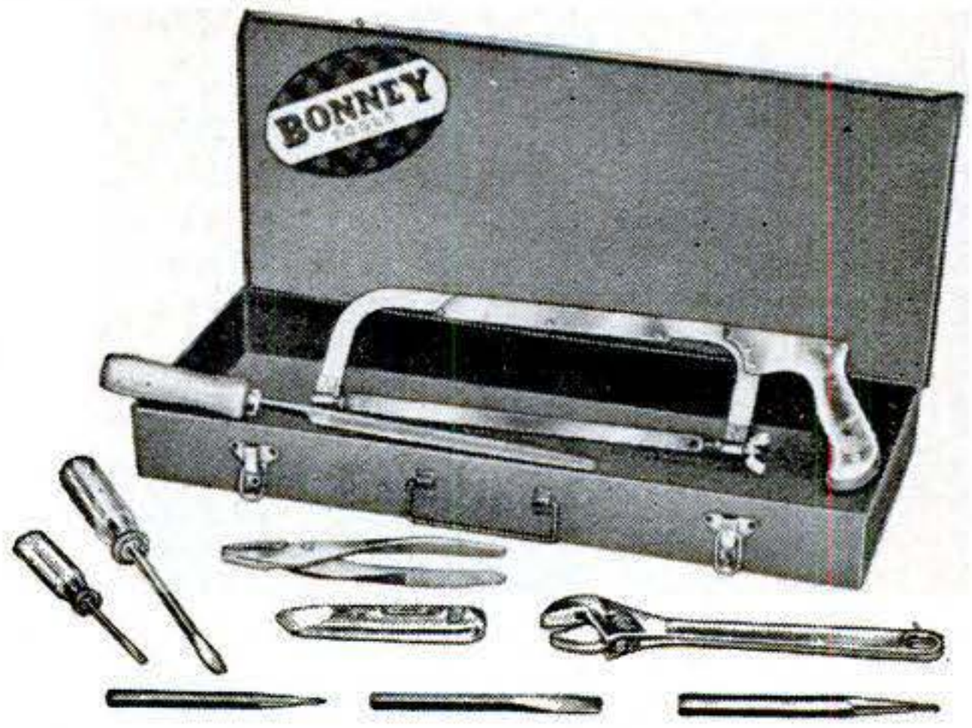
A Perfect Christmas Gift

for the man with a hobby!

What better Christmas gift than this? A set of famous Bonney Tools . . . the tools experts prefer! These are the famous fine tools that help the mechanic make the most of his skill. And these three popular Bonney Tool gift suggestions are perfect for Christmas. A hundred more suggestions—from a single tool to the most complete sets—in our big *free* catalog.

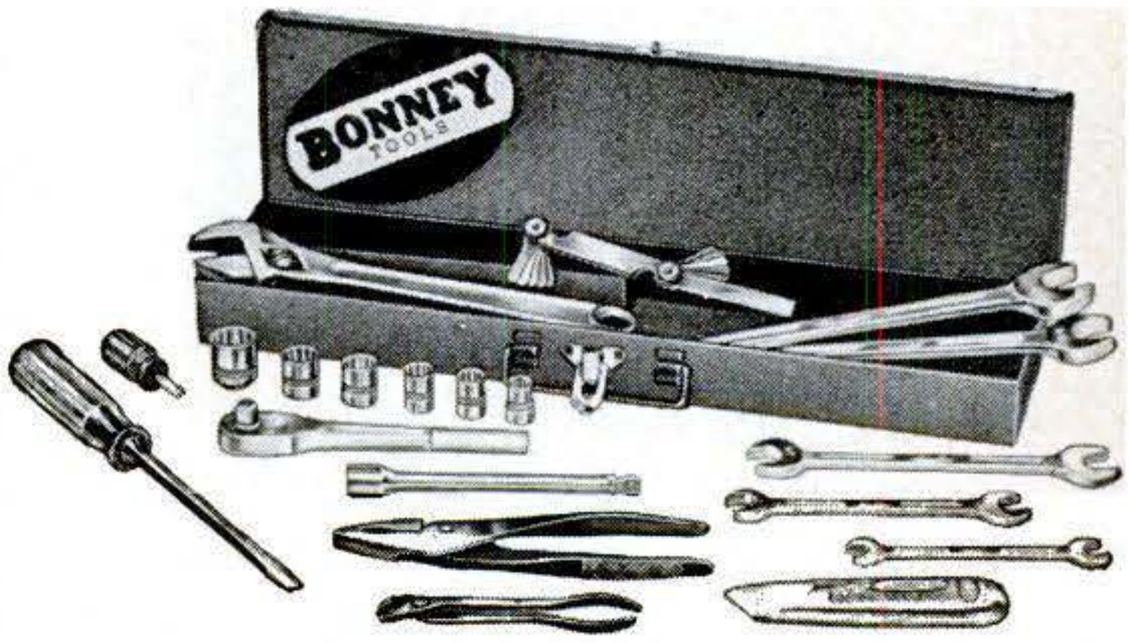


HOME WORKSHOP KIT (Type HWK)

11 fine tools for the man who is handy around the house. Two screwdrivers, one slip-joint cutter pliers, one 10″ adjustable end wrench, one punch, one chisel, one center-punch, one 3-blade shop knife, one 8″ half-round file and handle, one adjustable hack saw for 8″ to 12″ blades. With sturdy carrying box. Combination price $19.95.

HOT ROD KIT (Type HRK)

73 fine Bonney Tools for the hot rod and sports car enthusiast. Six ¼″ drive sockets with reversible ratchet and 6″ extension. Five ⅜″ drive sockets with reversible ratchet, universal joint, wobble drive, standard extension, and hinge handle. Thirteen ½″ square drive sockets, three extra-deep sockets, reversible ratchet, 5″ and 10″ extensions, universal joint and hinge handle. Eleven streamlined combination wrenches. 11-piece ignition set. Four screwdrivers and one screw starter. Three pairs of pliers. One 3-blade shop knife. One feeler gauge set. Carrying box with padlock hasp. Combination price $127.75.



AUTOMOBILE KIT (Type ABK)

23 fine tools that belong in every car. Worth their weight in gold in roadside emergencies. Five streamlined open end wrenches, seven square drive sockets with 6″ wobble drive extension and reversible ratchet, three screwdrivers, one slip-joint pliers, one ignition pliers, 10″ adjustable end wrench, 3-blade shop knife, 10-blade ignition gauge with point file. With sturdy carrying box. Combination price $37.75.

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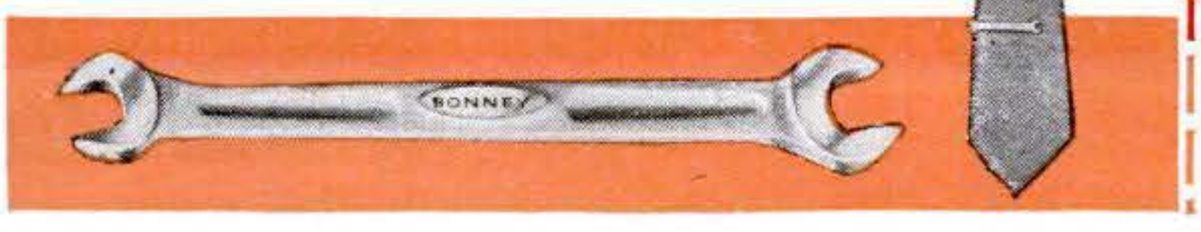

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For any camera with built-in "synch." Includes 2-Way Flashguard. **Kodak Flasholder,** Model B, $12.35.

Connects to Flasholder, for multiple-flash pictures. **Kodak Flasholder Extension Unit, Model B,** $13.65.

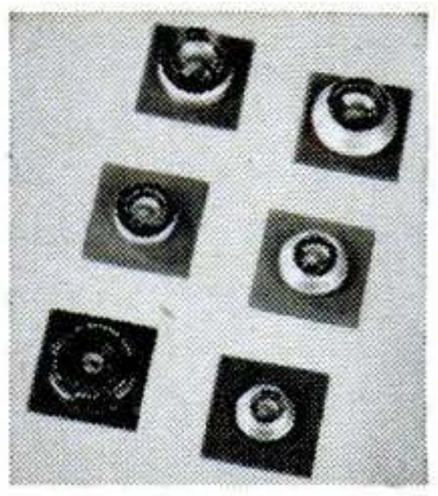
For use with new Brownie Hawkeye Camera, Flash Model. Easy to attach. **Kodalite Flasholder,** $3.95.

For flash pictures with any camera that has a "T" or "B" setting. **Kodak Photo Flasher,** $1.55.

Condenser-type power for dependable "flash." **Kodak B-C Flashpack,** $2.95 (without 22½-volt battery).

Sensational new battery-condenser flash system. **Kodak Ektalux Flasholder,** standard bracket, $34.75.

Cool, circline fluorescent lamp, integrating-sphere lamphouse are prominent features in each enlarger. **Kodak Hobbyist Enlarger** (left), $49.50, complete with f/6.3 lens. Versatile **Kodak Flurolite Enlarger** (right), $112.50, without lens.



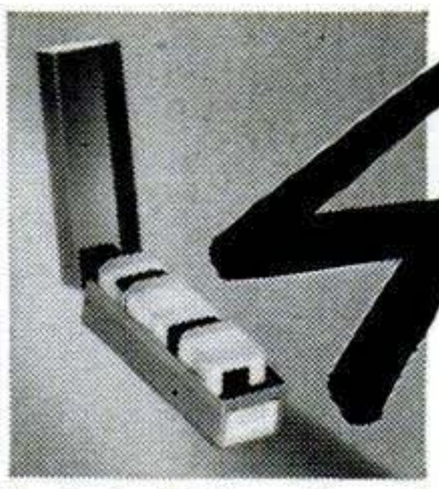
Lenses for the Flurolite Enlarger range from **50mm. f/4.5 "Ektanon"** to **4-inch f/4.5 "Ektar."** From $15.75.

2 x 2 projector and screen in a single unit. Use in lighted room. **Kodaslide Table Viewer, 4X,** $49.50.

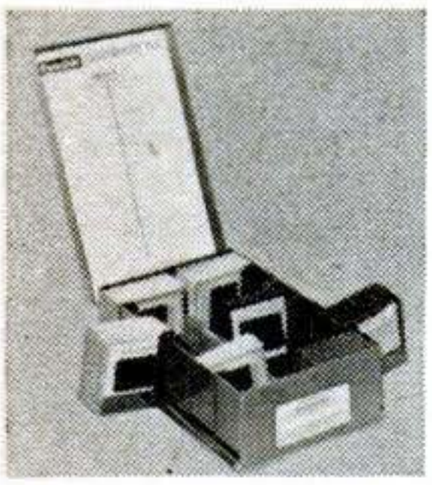
Self-contained projector, screen, and slide changer. **Kodaslide Table Viewer, Model A,** $97.50.

Projects images up to 7 ft. wide for brilliant shows. **Kodaslide Projector, Model 2A,** with 5-inch lens, $49.50.

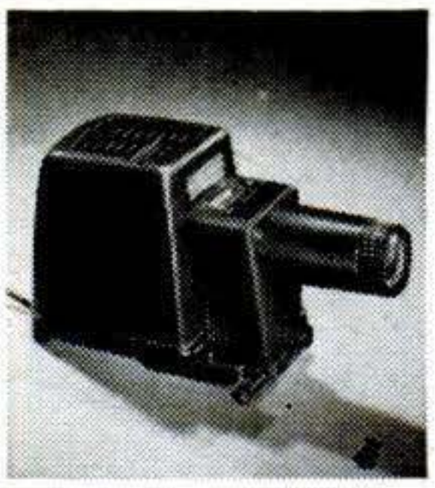
Can deliver more light than any 2 x 2 slide projector. **Kodaslide Projector, Master Model.** From $169.



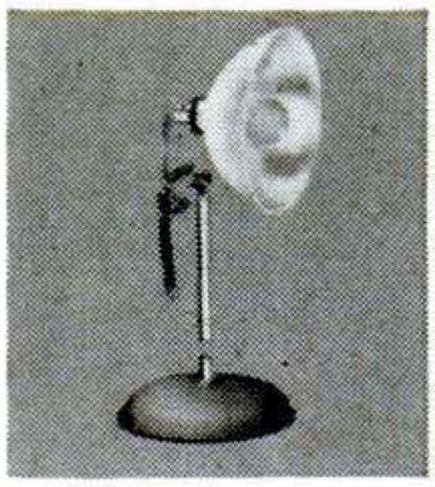
Protects 140 cardboard or 55 glass slides — keeps them organized. **Kodaslide File Box.** $1.50.



12 compartments swing out — hold 240 cardboard or 96 glass slides. **Kodaslide Compartment File,** $3.75.



New-type slide-feeding mechanism, cool operation, elevating device. **Kodaslide Merit Projector,** $24.50.



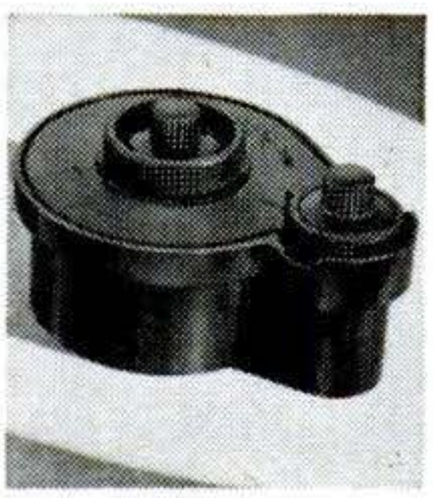
Focuses from narrow to wide beam for flood shots. Adjusts for heights from 3 to 5½ feet. **Kodak Vari-Beam Standlight** (left), $16. **Kodak Vari-Beam Clamplight** (right), lamp portion of Standlight mounted on flexible locking bracket, $10.50.

Easy-to-use materials for printing pictures — ideal for beginners. **Kodacraft Printing Kit,** $4.85.

Essentials for developing and printing, including roll-film tank. **Kodacraft Photo-Lab Outfit,** $8.50.

Complete developing, printing equipment, incl. metal printer. **Kodacraft Advanced Photo-Lab,** $13.95.

Easy to use, load, and pour. Takes 620-120, 616-116, and 127 films. **Kodacraft Roll-Film Tank,** $2.95.



Permits loading and processing of 35mm. films to be carried out in daylight. **Kodak Day-Load Tank,** $9.85.

Handsome chemical-resistant plastic housing protects all working parts. **Kodak Chemical Scales,** $9.90.

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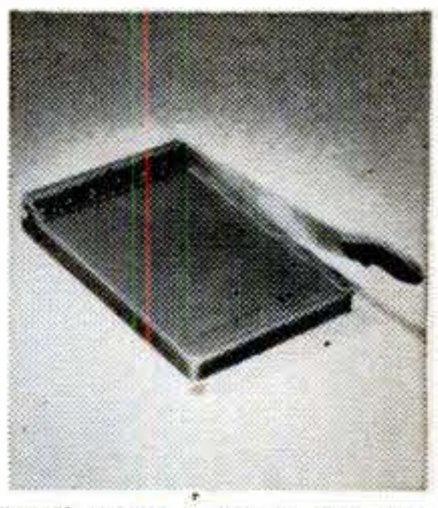
Gives precise timing in contact and projection printing, 1 to 57 seconds. **Kodak Electric Time Control,** $13.50.

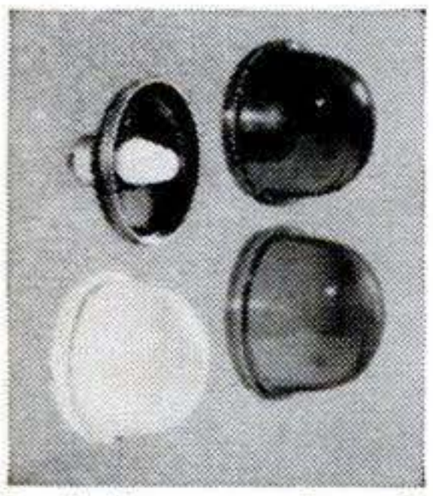
Tilting base, minute and split-second hands, large dial. Covers intervals to 60 minutes. **Kodak Timer,** $6.75.

Permanent mounting. **Kodak Thermount Iron,** $9.75. **Kodak Thermount Tissue,** from $.20 per pkg.

Frees both hands for handling equipment and material in the darkroom. **Kodak Utility Footswitch,** $10.

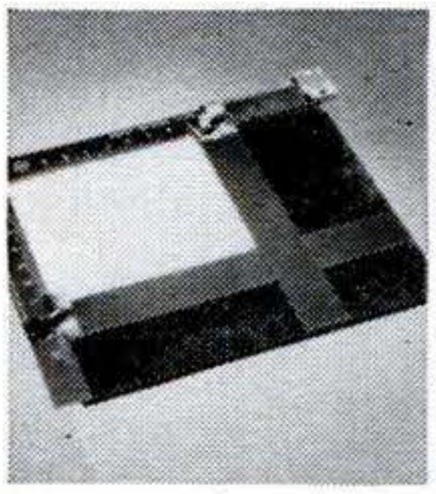


Will trim prints up to 6½ x 8½ in. Rigid single-piece metal body. **Kodak Guide-Rite Trimmer,** $5.85.

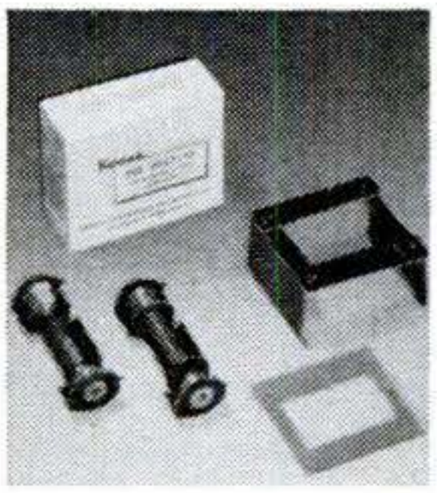


Includes cups for all types of darkroom work. **Brownie Darkroom Lamp Kit,** $1.95.

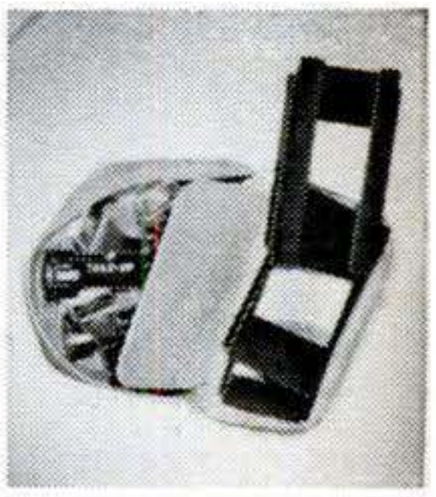
Converts tray to efficient print washer. **Kodak Automatic Tray Siphon,** $5.25.



For use with any vertical enlarger. **Kodak Masking Easel, 11 x 14,** $11.25.



Now use economical 828-size color films. **Kodak 828 Adapter for Kodak Reflex Cameras,** $5.35.



Adapts de luxe model Kodak Tourist Cameras to take Kodachrome Film. **Kodak Tourist Adapter Kit,** $15.50.

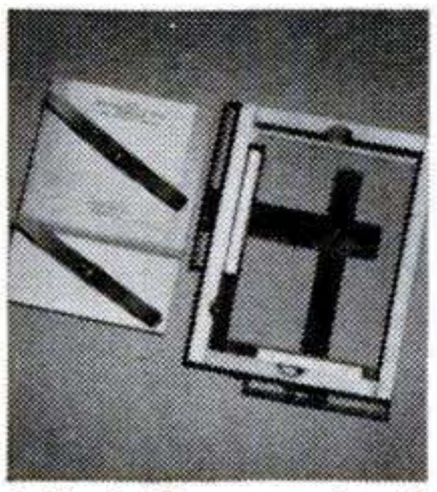
Gift Ideas for Photo Fans

Your photo dealer will be glad to show you many wonderful gift ideas. Visit him soon.

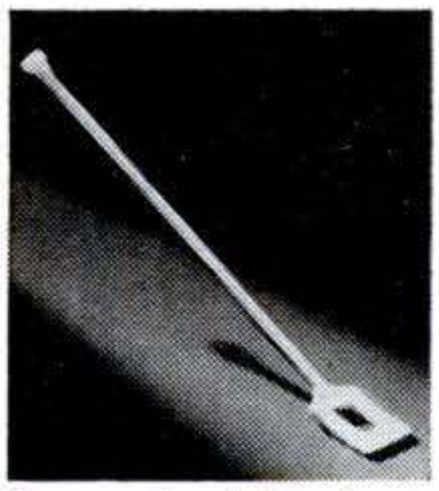
Automatically trips shutter, permits photographer to get into picture. **Kodak Auto-Release,** $4.50.

Keep negatives dirt-and-dust-free, safe from scratching and marring. **Kodak Negative Files.** From $2.25.

For accurate darkroom temperature control. Choice of 4 **Kodak thermometers,** from $.45.

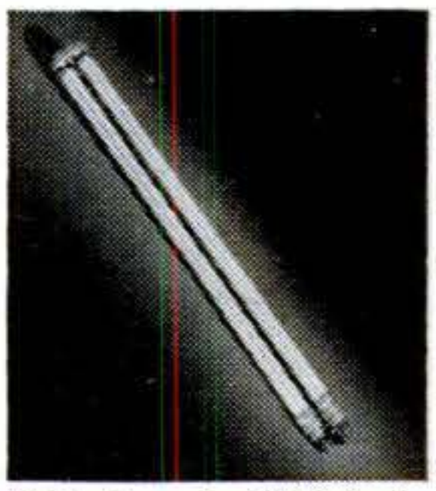


Adjustable—accepts all sizes of negatives up to 4 x 5½ in. **Kodak Auto-Mask Printing Frame,** $3.25.



Convenient for handling prints in a tray or for stirring solutions. **Kodak Stirring Paddle,** $.35.

Expertly made, offers sound protection together with smart appearance. **Kodak carrying case.** From $2.65.



Folds to only 22½ inches — extends to 5 feet. Weight, two pounds. **Kodak Eye-Level Tripod,** $23.33.

Holds 4 filters, adapter ring, lens hood. **Kodak Combination Filter Case,** $4.25, $4.95.

Made of strong, waterproof vinyl plastic. **Kodak Darkroom Apron,** $2.25, $3.00.

Shades the lens, attaches directly to adapter ring. **Kodak Lens Hood.** From $1.60.

Darkens the sky in color pictures. **Kodak Pola-Screen.** From $6.50.

Prices subject to change without notice and include Federal Tax where applicable. Consult your dealer.

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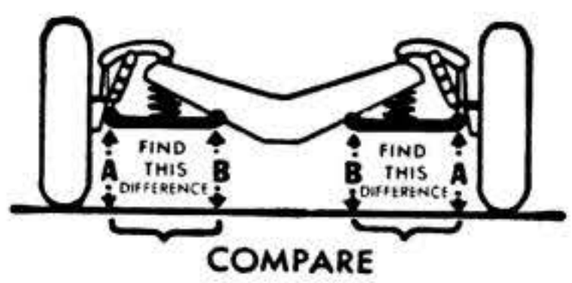
Care and Feeding of Engines

BY S. P. CORP

WHEN YOU HAVE "PULL"

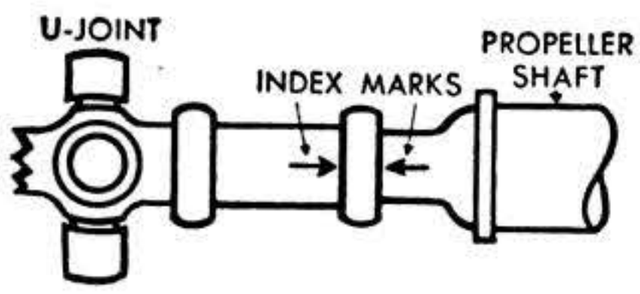
When your car pulls right or left, check spring height. Always do this, too, before aligning wheels. This check can be made on any level drive or garage floor. *First,* make sure car is empty. Then bounce car up and down to get springs and shock absorbers into their natural position. Measure from floor to fittings at A and B. (See diagram). There should not be more than ¼ inch difference between A and B. Before making any front correction, check rear spring heights by measuring from top of rear axle to car frame.



Any variation of more than ¾ inch in rear will affect front, and must be corrected first, by re-arching or replacing. If rear is O.K., correct front spring variation by placing spacers on top of coil springs. One spacer will raise low side ⅜ inch. Never use more than two spacers.

GETTING RID OF VIBRATION NOISE

Vibration can cause squeaks and rattles. One of the common causes of vibration is an unbalanced propeller shaft. On most cars, the propeller shaft is not enclosed, and sometimes catches a load of undercoating. Look for this if you hear a low rumble, and clean the shaft. If your car has two universal joints, you will find balance marks (see diagram). If these are out of line, shaft will vibrate. Disconnect and remove spline shaft from propeller shaft, then replace with balance marks properly lined up.



IF YOUR CAR SPENDS TOO MUCH

If your car spends too much of your good money for gas and oil make yourself a Christmas present of new Sealed Power Piston Rings. Sealed Power MD-50 is the best steel oil ring ever built —controls oil even in badly tapered and out-of-round bores. Ask for free booklet, "7 Ways to Save Oil." Just address a card to Sealed Power, Dept. H-12, Muskegon, Mich. For triple wear compression rings, get Sealed Power Chrome-Faced Rings.

Wanted: Science Talent

[*Continued from page 146*]

ought to be done with the talent they were turning up. The result was the Science Talent Search, aided by a yearly $11,000 grant for scholarships from the Westinghouse Educational Foundation.

Davis found two psychologists, Dr. Harold A. Edgerton and Dr. Steuart Britt, both with long experience in devising aptitude tests. He asked them to work out a contest scheme that would avoid narrow geniuses but be sure-fire in selecting the topnotch talent upon which scientific progress depends.

Students Face Four-Way Screening

The experts came up with a four-way screen: a tough test, a character recommendation from the entrant's science teacher, the student's school record, and an essay. This is called the "successive-hurdles method." Most of the youngsters trip over the first, a few more at the second and third. It is the essay that points to the real talent.

This is how a typical Search works today: The minute the schools open, Miss Patterson begins reminding thousands of teachers and science-club sponsors to prepare their best students for the fray. Early in December comes the great exam, held by each school under the honor system. Talent Search spends the whole year gathering new test questions; the exam is made so difficult that few college presidents could pass it. The two-and-a-half-hour grind covers a dozen pages of selective-choice questions, and the test is full of jokers to trap the unwary and the chap who doesn't think.

There is a generous infusion of diagrams. But the real brain-busters come toward the end in a section devoted to long, abstruse descriptions that end with questions you can't answer until you have cut through the blather to the data hidden beneath it.

Nobody ever made 100 percent on a Search test—most scores are in the region between 50 and 70 percent. Mighty few get into the 90-percent class.

Around Christmas time the Science Service offices burn their lights all night, as the tests are graded. Gradually, of the 15,000 or more students who have competed, all but 400 have been weeded out. Not till then are the essays read.

Four experienced readers tackle the essays, judging them on originality, com-

[*Continued on page 246*]

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This new 20-page booklet provides many useful how-to-do-it ideas for both amateurs and professional mechanics, as well as basic information on the proper selection, use and care of hand tools. It contains 46 action illustrations and describes and illustrates 47 popular Crescent and Crestoloy Tools. Simply fill in and mail the coupon below, and a copy will be sent to you with our compliments.

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JAMESTOWN, N. Y.

WRENCHES . . . . . *and how to use them*

A prime rule in using any adjustable wrench is to first adjust it to a snug fit on the nut to be turned. (Fig. 7.) A tightly adjusted wrench is safer since danger of slippage is minimized. A loosely fitted wrench will tend to "round" the corners of hexagonal objects, and may damage the wrench by exerting undue strains on the jaws. Greasy, oil-covered tools are dangerous. Keep handles clean and dry by occasional wiping. Oil should be applied sparingly to moving parts.

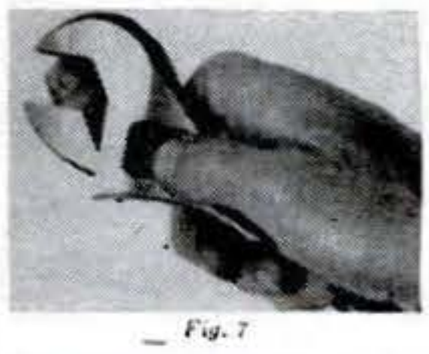

Fig. 7

Adjustable Wrenches develop their greatest strength when hand pressure is applied to the side of the wrench carrying the fixed jaw as in Fig. 8. They can, however, be pulled in either direction on moderate loads, and are frequently "flopped" between

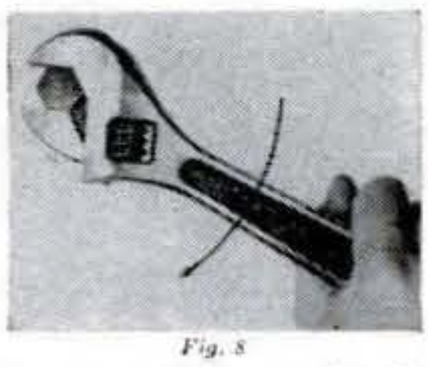

Fig. 8

swings to gain an angular advantage and permit continuous rotation of nuts or bolts where cramped quarters limit the handle swing.

"Crestoloy" Wrenches, being thinner (and stronger) than "Crescent" Wrenches, are the preferred tools for use in cramped quarters or when adjustable wrenches are used in pairs as in Fig. 9. For extremely heavy loads, Crestoloys are likewise recommended. (See tools illustrated page 15.)

Fig. 9

PLIERS . . . . . *and how to use them*

Slip Joint Pliers

Crescent Slip Joint Pliers are a general purpose tool having excellent gripping power over a wide capacity range because of their adjustable jaws. Ideal for holding or turning round pieces. Should not be used on nuts or bolt heads. (See tools illustrated page 15.)

Fig. 10

Skinning Insulated Wire

Fig. 12 illustrates the proper way to grasp a light, diagonal plier. The third and little finger "inside" the handles provide pressure to hold the jaws apart. Pressure of the thumb stabilizes the tool and maintains desired jaw opening.

To skin wire, grasp it as shown with the left hand, as in Fig. 11. Now with plier held, as shown, close the jaws sufficiently to cut through the insulation *only*. Don't cut through the conductor!

Fig. 11

Now "rock" plier handles toward left wrist and the prying action will strip the insulation from the wire end.

"Cleaning" or brightening of the bare wire is shown in Fig. 12. Close jaws just enough to provide slight pressure and draw cutter blades along the bare wire a few times. Rotate wire with left hand so that the entire circumference is clean. (See tools illustrated page 17.)

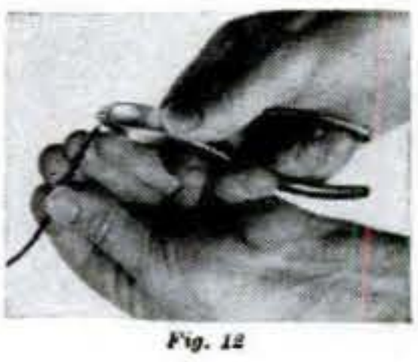

Fig. 12

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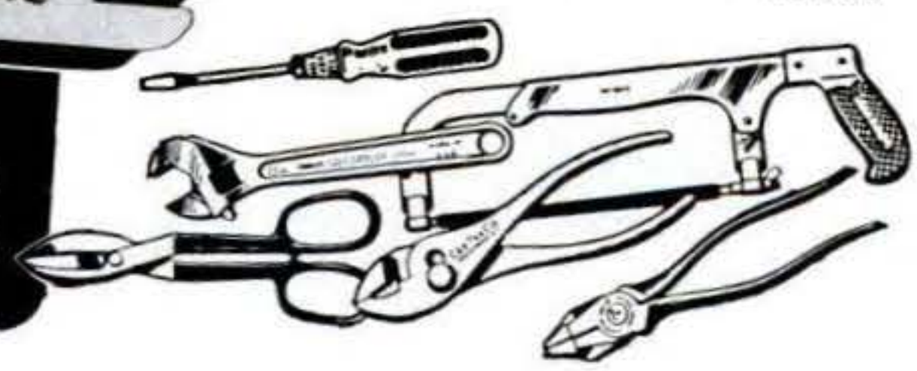
Give Wings to Work

Sign of the Artisan
Symbol of Excellence

"Crescent" is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by Crescent Tool Company, Jamestown, N. Y.



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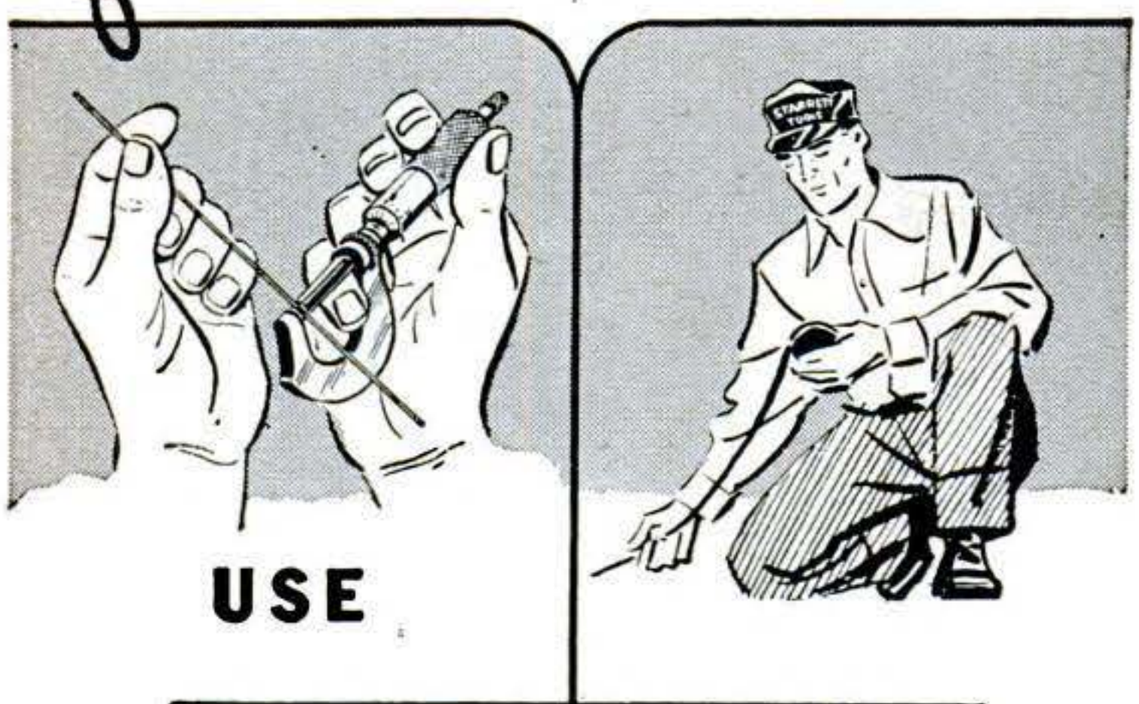

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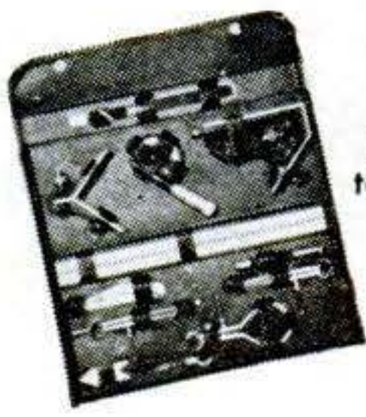

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Flexible Steel Rule No. 327 6" length, graduated two sides

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Wanted: Science Talent

[Continued from page 244]

pleteness and "scientific potential." With the preliminary selecting done, four judges agonize over the slight differences among 300 brilliant survivors. The list is finally pared to 40 "finalists" and 260 "honorable mentions." It is a wonderful day for those 40 when, in January, they receive a telegram which begins: "Congratulations. You have won a Washington trip . . ."

Finalists Meet the President

In early March the five-day Institute begins, and the happy finalists descend upon the capital. There are sight-seeing tours, talks with top scientists, special parties in government laboratories, receptions by Representatives and Senators, presentations to the President.

Now the final cut is made to pick the two top winners and the eight runners-up. Every contestant must submit to the exquisite torture of a recorded interview with each of the four judges. In these star-chamber proceedings anything can happen. Shapley, for instance, likes to fire at his victims such a bombshell as this: "Two days from now a billion-ton asteroid will hit Washington. You are in charge of everything. What will you do?"

Most kids keep their nerve and turn in thoughtful answers. When it is all over, the top winners are announced at a final banquet and the youngsters go home.

The Talent Search staff later makes breakdown studies of the winners and their backgrounds. Their parents form a good cross section of the American middle class. A few fathers are famous scientists; sometimes the mothers are also. But mainly the mothers are homemakers only and the fathers are farmers, businessmen, shopkeepers, ministers and teachers. Two things seem to count most: good school equipment and teachers of high skill.

Even in a short 10 years the validity of the Search idea has been established by the achievements of its product. Girls and boys alike are already crowding established scientists for honors in some fields. Besides the remarkable Marina Prajmovsky, there is Carol Pike, who has become a chemical engineer and a founder of the world's first Society of Woman Engineers. There is Rodman Jenkins, who won a degree at M.I.T. at the age of 17 and is now in ad-

[Continued on page 248]

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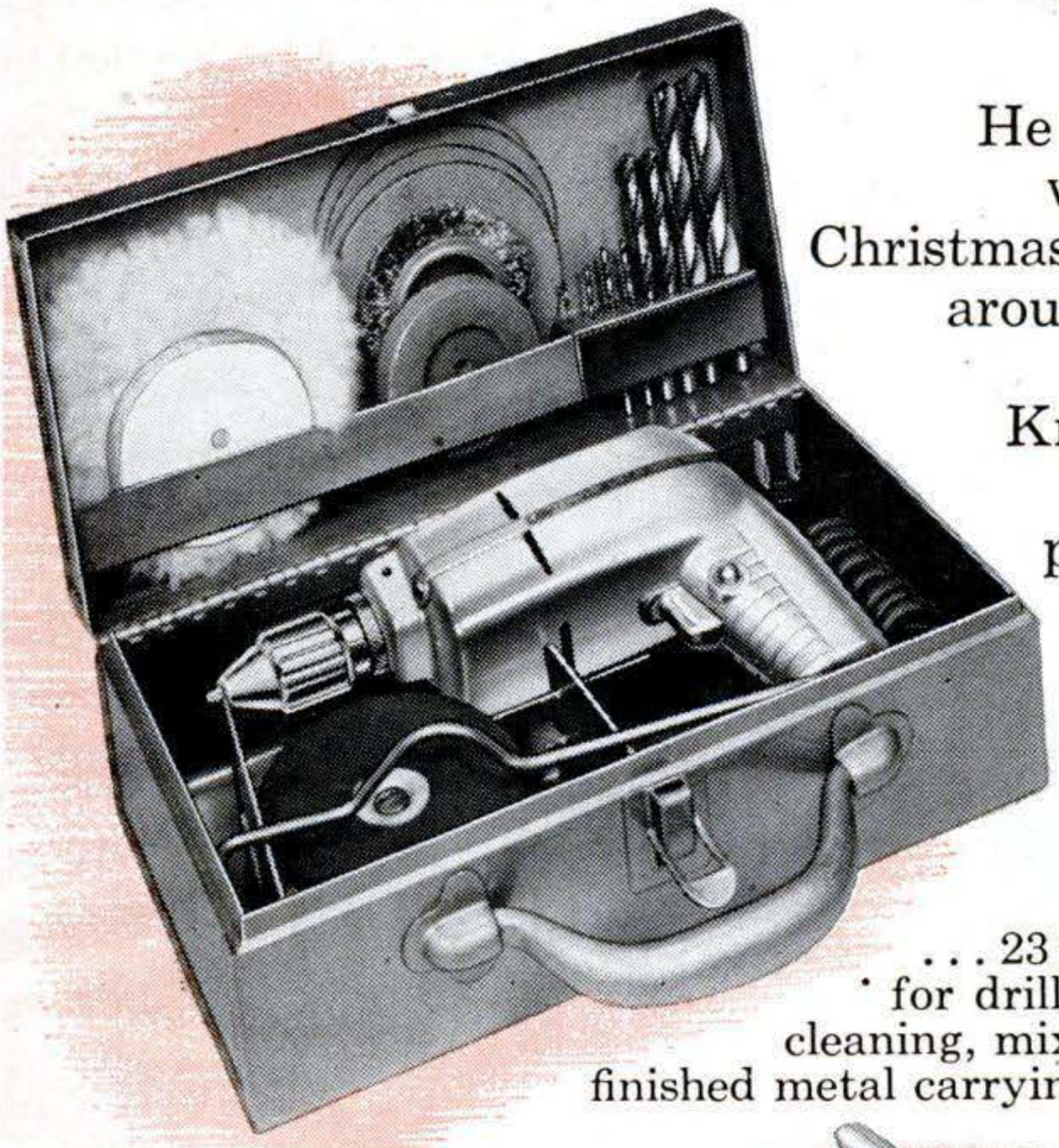
Lifetime Christmas Gifts

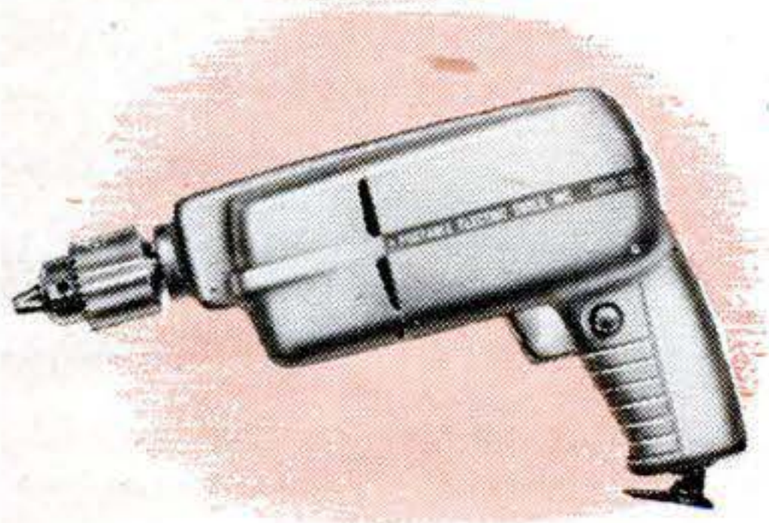
PET TOOLS

Every Man Wants ELECTRIC TOOLS



He will appreciate your thoughtfulness when you give him a PET Tool this Christmas. He can then do hundreds of jobs around the house, on the farm, or in his shop—easier—faster—better. Known for their light weight, modern streamline design, and dependable performance, PET Tools are packed with power, safe and easy to use, and priced right. Truly great gifts that will give years of usefulness and enjoyment to any man.

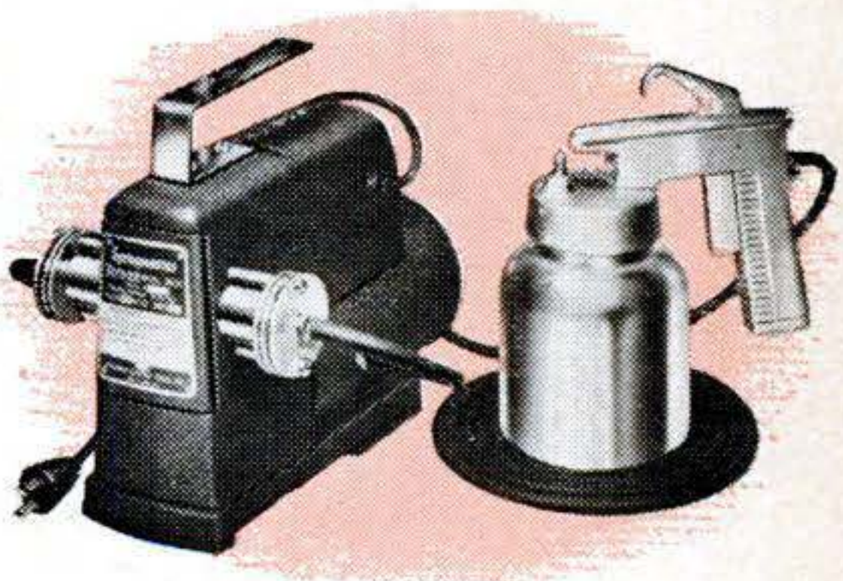
ZEPHYR 1950—HDK De Luxe Drill Kit . . . 23 pieces with ¼" electric drill and accessories for drilling, grinding, sanding, polishing, buffing, cleaning, mixing paint, etc. Complete with beautifully finished metal carrying case. **$27.35**



ZEPHYR 1950-H ¼" Electric Drill with hand-operated chuck, AC-DC motor. **$18.95**

Drill stands available—extra.

ZEPHYR 625 Electric Hand Saw. Depth of cut, 2⅛". Adjustable for depth and angle. AC-DC motor. **$47.50.** Tables extra for converting to table power saw.



ZEPHYR SM-25 Spraymaster Portable Spray Outfit for paint, lacquer, insecticides, etc. Complete with AC-DC motor **$28.95**

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[*Continued from page 246*]

vanced research on petroleum in Texas. Wolf Karo holds a top-ranking job with the National Advisory Committee for Aeronautics in Cleveland, and is developing new fuels for jets and rockets.

Paul Teschan and Paul Cranefield are two more outstanding successes. Teschan was already headed for medicine when the Search found him in 1942. In college he got interested in research on kidney ailments, but the one hospital in Boston where such work was done would not take him on. He was too young, they said. Then he got into the Army and wound up at Walter Reed Hospital as a laboratory assistant. Now he is a department director there, a leading authority on uremia and the inventor of an artificial kidney technique he hopes will cure it.

Paul Cranefield, meanwhile, is doing a quiet job at a Madison, Wis., laboratory on cardiac injury and epilepsy. He has a mild form of epilepsy himself, and the chances are that if STS hadn't found him he would never have become a scientist at all. Some day every epileptic in the world may have reason to thank the Search for Paul Cranefield, for he is on the track of a solution to their ills.

Scientist Must Combine Many Talents

Some years ago Dr. Vannevar Bush addressed the Search banquet in these inspiring words:

"In the exploration of the unknown the price of one success is often many failures. The ability to detect failure early, and the capacity to abandon a line of approach, however treasured and however far committed, are vital elements in the complex compound of plan, reason, patience and courage out of which new knowledge is gained.

"The great quality is not simply to be able to stand up under disappointments, but to do so without losing the zest and exhilaration that should attend success."

Fortunately for America, the Science Talent Search is finding thousands of young people who will follow this ideal. END

UNCLE WALTER

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When you and your wife talk about practical gifts this year, put in a plug for the Power King tools you need in your shop. Have her see them at your Atlas-Power King dealers. PK tools, better than any others, give you the capacity and accuracy you want *plus* rugged construction and proper bearings for long service. They're fun to operate and, used wisely for home improvement and furniture building, can save you hundreds of dollars. FREE — new catalog with operating views and hints — send a postcard, we'll rush it.

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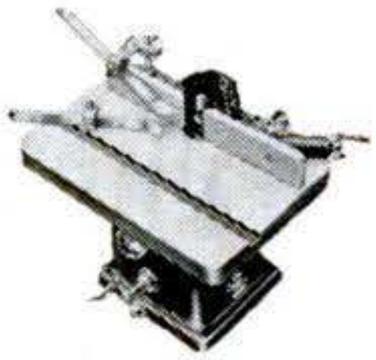

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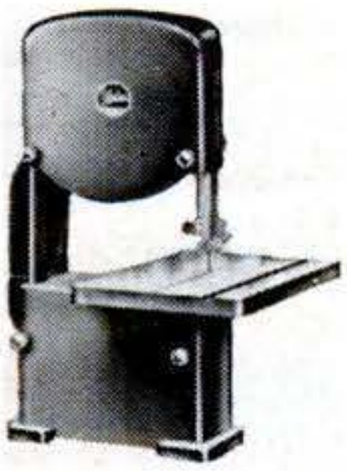

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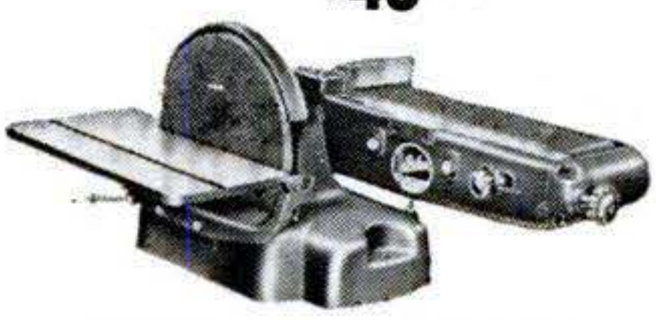

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THE BLACK & DECKER MFG. CO., Dept. H12S, Towson 4, Md.

[*Continued from page 240*]

first piece by one end without butting it against the column. Before he could let up on the feed, the strip had torn free and smacked the column. The bent drill spun drunkenly until he shut off the motor.

"Now why did that happen?" he asked. "It's only 1/16" thick. But it grabbed just as I broke through."

"Yes, because it's light enough to have some spring-back. The end under the drill was free to lift. So it climbed the drill, even though you eased up on the feed."

"That's what sheet metal does."

"Yes. Best way to drill sheet metal is to clamp it between two pieces of wood, when you can. Even a stiff backing helps—a board under it, instead of just the hole in the table. And, of course, never hold sheet metal in the hand—unless you have spare fingers."

Whistling, Jim went back to his job.

"Hey," sputtered Larry. "What do I do about this bent drill?"

Fixing the Bends

"Bend it back. Put a block on the table, turn the spindle by hand, and bend the drill toward the block when it's farthest away. Or roll it on the drill-press table and squint at the light under it. Put it on a block of wood and hit the high part with a soft hammer."

Larry grunted, sighted the drill as instructed, and after a few minutes turned on the motor. The drill ran true.

"That did it," he announced contentedly.

The rest of the job went without mishap. Later they had a midnight snack left for them by Jim's wife. The porch table stood nearby on its own legs.

"Never thought I'd get it put together tonight," exclaimed Larry. "And I've learned a few things, too." A faraway look came into his eyes. "Say, I think I'll make a wrought-iron railing for my front step."

"Lots of rivet holes to drill."

Larry waved a doughnut cheerily. "That's okay. From now on I can keep my eye on the project, and not just on the holes." END

Pressure Pushes Soda Up Straw

You don't really pull up the liquid in a straw when you're drinking soda. Your sucking action creates a low-pressure area in your mouth. The higher air pressure on the surface of the liquid in the glass then pushes the fluid up the straw.

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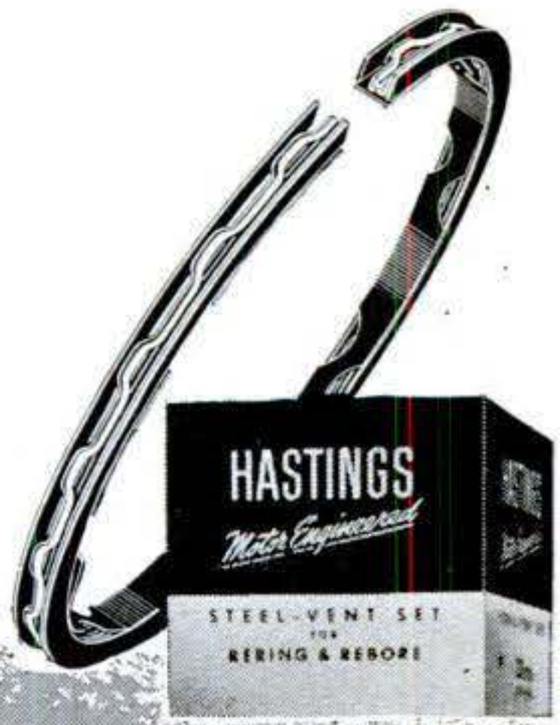

Gus Cracks the Ice for Santa

[Continued from page 198]

"Keep your coats on, boys," called Stan as Gus and Tony climbed off the truck. "It's almost as cold in here as it is outside. I'm afraid little Stanley forgot to put some coal on the fire when we left to help out Doc Marvin."

"Well, start stokin'," said Gus. "And when you finish that, how about brewin' some coffee on the hot plate?"

"Heat and java coming up."

A Tough Spot for Tony

"Well, Tony," said Gus, "now let's see if we can find out what's causing this truck of yours to shake. I hate to say it, but I'm afraid that maybe the universal on your drive shaft is shot."

"Is that bad?"

"It ain't good," replied Gus as he wheeled a jack under the truck's differential. "If that's the trouble, I'm afraid you won't deliver those trees tonight."

"Don't say that, Gus. I gotta get those trees into the city tonight. No trees tonight, the man said, no business. No business and I'm stuck with a coupla hundred trees."

When Gus had the rear wheels of the truck raised up off the floor he climbed into the driver's seat, started the engine, put the gearshift in high, and walked around to the rear of the truck again. At idling speed, there seemed to be little or no vibration. Without actually getting under the truck, Gus kneeled down, trouble light in hand, and inspected the drive shaft. He couldn't see any side movement.

"Anything I can do while the coffee's brewin'?" asked Stan.

"Yeah, there is. Put two permanent screw jacks under that rear axle. I want to get underneath and have a look while you give the engine the gun."

Gus Goes Looking for Trouble

When Stan had put the two jacks in place and had climbed into the driver's seat, Gus stretched out on his creeper and wheeled himself under the truck.

"Stan," he called. "Give her the gas until she starts to shake, then ease off. Remember I'm under here, so don't push her too far. She might wiggle herself off these jacks and I don't want to be under here if she does."

"Okay, Gus, here she goes."

Stan repeated the process of speeding up

[Continued on page 254]

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SPARKING THE OLDSMOBILE *"ROCKET"...*

. . . and used as factory equipment on more of America's new cars than any other make

What have AC Spark Plugs for Oldsmobile got that other plugs haven't? They have *CORALOX,* AC's patented Insulator, which has set the engineering world a-buzzing.

Oldsmobile was quick to see the advantages of this revolutionary invention—and to cooperate with AC in selecting a plug type exactly suited to the famous "Rocket" engine.

Necessity was the mother of *CORALOX.* This rugged insulator simply *had* to be invented, because previous types of spark plug insulators couldn't stand up under the operating conditions imposed by modern high-compression engines and modern fuels. They cracked and blistered under the extreme heat—they fouled and misfired under heavy load, when power was needed most.

CORALOX ended all that—brought spark plugs to an all-time pinnacle of efficiency.

AC Spark Plugs with patented *CORALOX* Insulator are therefore standard, not only on the Oldsmobile "Rocket," but on more of America's new cars than any other make. That's how good the newest AC Spark Plugs are. They are helping thousands of Oldsmobile owners to preserve top engine performance—and they'll do the same for you.

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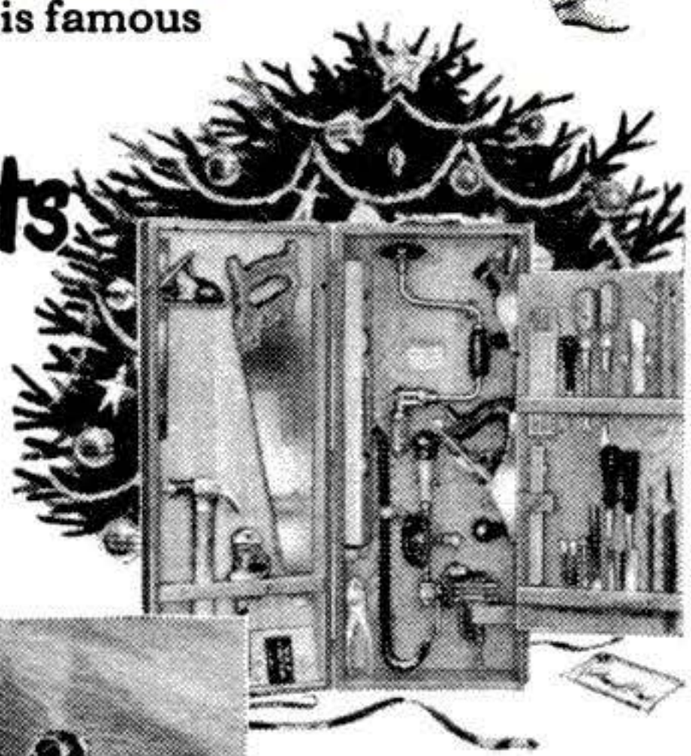

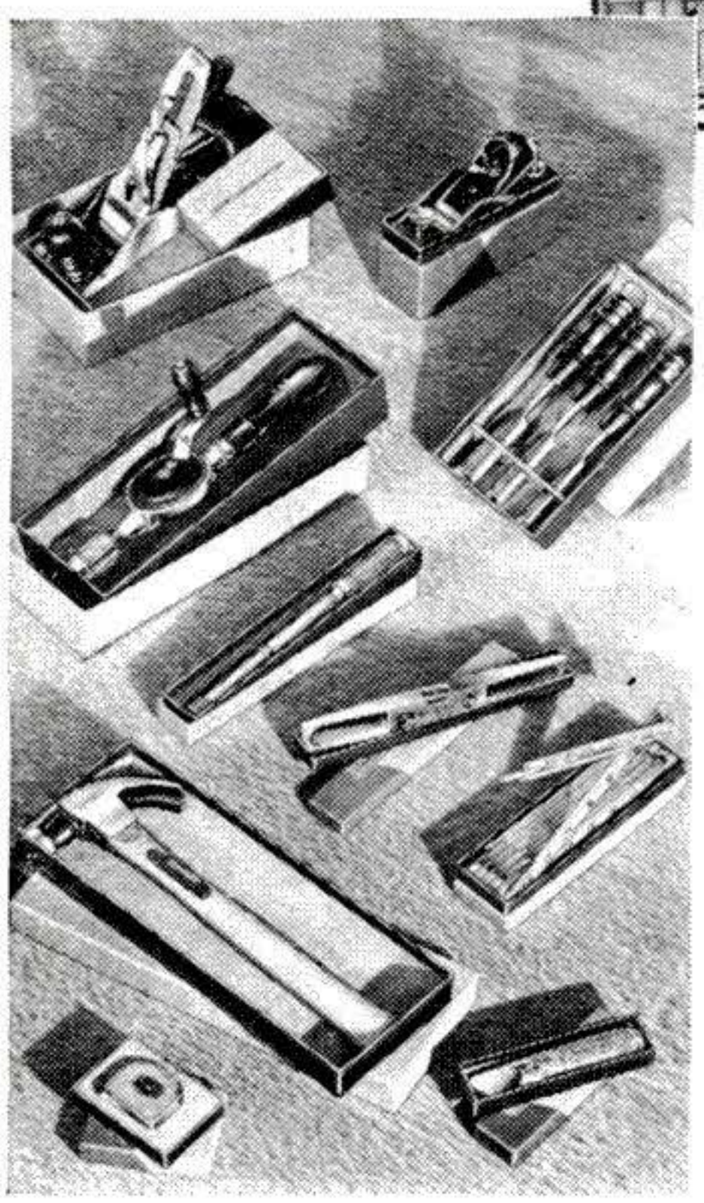

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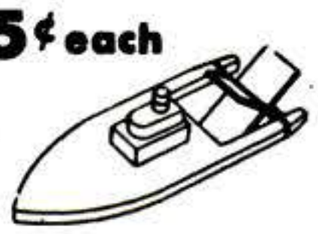

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Gus Cracks the Ice for Santa

[*Continued from page 252*]

the truck's engine and then letting it slow down several times. Finally, from under the truck Gus's voice told him to shut the engine off.

"Find anything?" Stan asked when he joined Gus at the rear of the truck.

Truck Shimmies Like Gilda Gray

Gus shook his head as he wiped his hands on a batch of waste. "Not a thing. There's not a sign of anything the matter with the drive shaft, yet every time you gunned the engine the old chassis started to shimmy like Gilda Gray."

"Like who?" asked Stan.

"Forget it," said Gus. "I guess she was before your time."

"Well, at least the heat's coming up," Stan announced, shedding his coat. "What's the next step?"

"Think you can fix her, Gus?" chimed in Tony.

"I think so," Gus lied.

Then Gus did what he always did when some repair job had got him down. He perched on his bench and began thumbing shreds of tobacco into his pipe. He was just about to put a match to it, when he stopped, blew out the match, and slid down off the bench. A moment later he was on the creeper and had disappeared under the truck again.

Tony looked at Stan and shrugged.

A Quick Hunch Pays Off

A few seconds later, Gus's graying head popped out from under the truck. "Stan, get me a cold chisel and a hammer, will you?"

When Stan had handed him the tools, his head popped in again and presently Stan and Tony heard some dull thuds followed by a metal-against-metal clanking. Finally the noise stopped and Gus, still on his back on the creeper, slid out. He looked up at Stan and Tony and grinned.

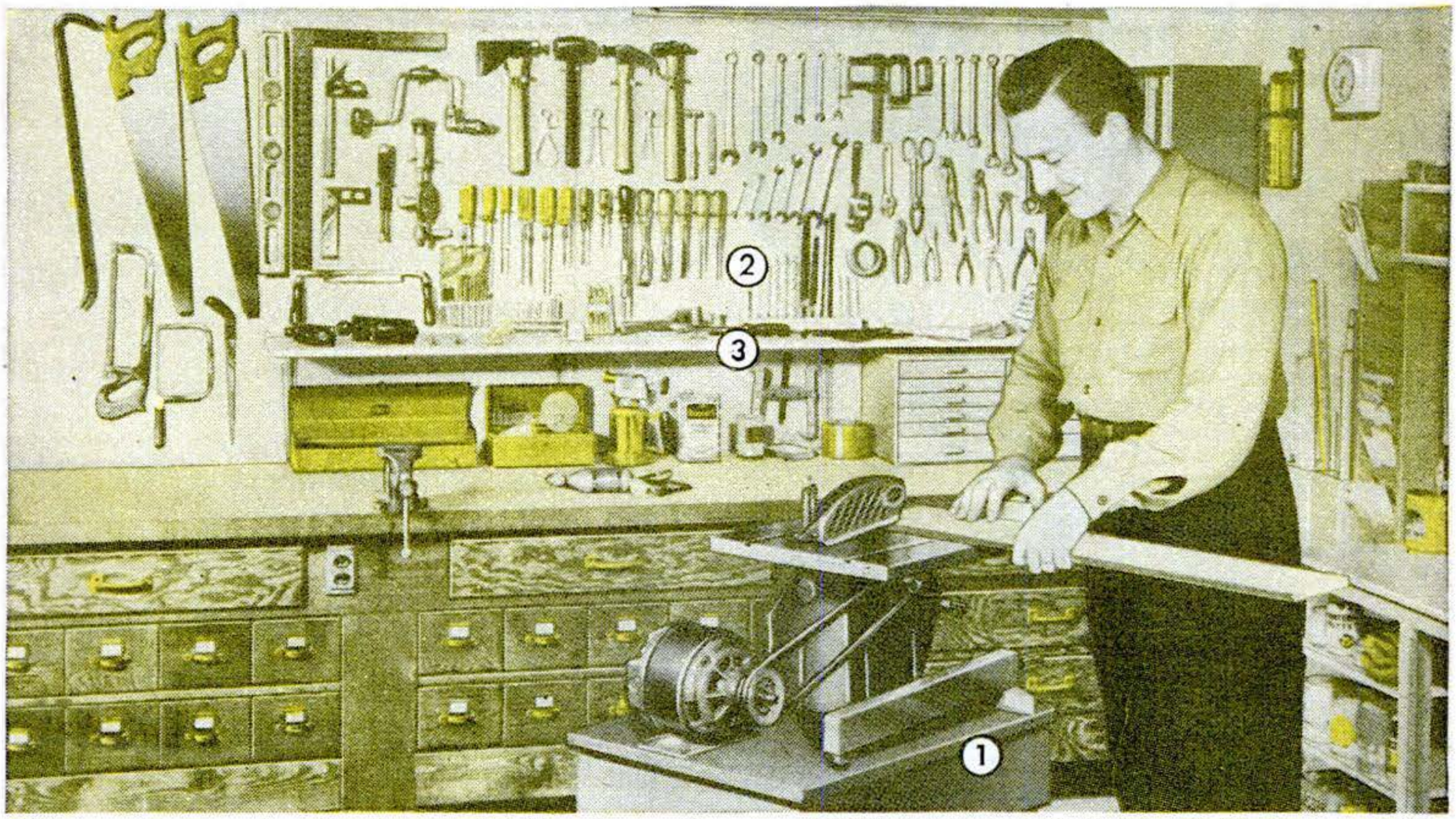
"Let's try her again. Tony, I think we've found the source of your wiggle."

Stan clambered up into the cab again while Gus and Tony watched. Stan fed the gas slowly at first. No vibration. Then he really tramped down on the pedal. Still no shakes or shimmies other than the normal vibrations that were set up by the racing engine.

"She's fixed," shouted Tony gleefully,

[*Continued on page 256*]

This Christmas, See How Little It Costs To Give Famous Professional Quality Westcraft Tools



Why pay fancy prices for fine tools? See, try and compare Westcraft—you'll discover that these famous, shop-tested tools give you the same precision manufacturing and lasting accuracy of other brands costing far more. Westcraft Tools are fully guaranteed and are yours on easy terms. Here are a few from our complete selection—see them this week at Western Auto!...

① **7" Tilt Table Bench Saw.** 14"x16" table. Performs 8 different cutting operations. Ball bearing arbor. 2 3/16" cutting depth. Only . . . .(2HR1002) **$39.40**

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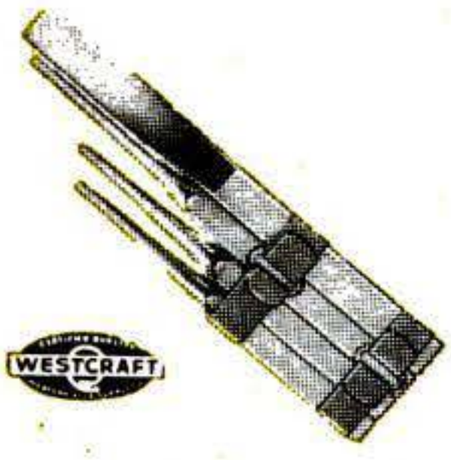
③ **Soldering Iron,** 100 watt. ⅞"x1¾" copper tip. Nickel-chrome sealed element . . . (4HR4316) . . . **$2.00**



Punch & Chisel Set, precision ground and tempered. Chrome plated, polished alloy steel. 4 pieces in carrying kit. (HR1577) **$1.63**

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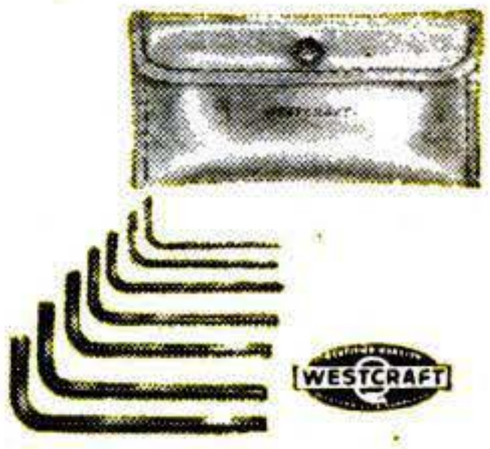

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Gus Cracks the Ice for Santa

[*Continued from page 254*]

clapping Gus on the back. "What did you do?"

"Tony, where did you park that truck this afternoon?" asked Gus.

"Same place as always. In the yard outside my house."

"Much snow there?"

"Sure, plenty. Maybe two feet, maybe more."

"Well, you evidently scooped up quite a hunk of it on the flange of your emergency-brake drum that's mounted on the drive shaft," explained Gus. "It froze there. Then as you drove along it picked up dirt, sand and more ice from the snow kicked up by your front wheels."

Tony still looked a bit puzzled.

"You see, Tony, that hunk of ice and dirt added considerable weight to one point on your emergency-brake drum and when the drum, mounted as it is on the drive shaft, turned at high speed, it set up quite a vibration. It was out of balance."

"But how did you spot the trouble?"

"While I was sitting up there on my bench trying to think what might cause it, I happened to spot that little trickle of water coming out from under the truck," Gus explained, pointing down at the floor. "That gave me a hunch what was wrong. Then I looked and found that glob of ice and dirt on the brake drum. It had started to melt as the shop warmed up."

Gus Gets a Christmas Tree

Later, when Tony had paid his bill, had insisted on leaving one of his Christmas trees so that Gus and Stan could decorate the garage for the holidays, and was backing out of the shop, he suddenly stopped and poked his head out of the driver's window.

"Say, Gus," he called out, "do you think that big ape really means to sue?"

"Not a chance," grinned Gus. "After all, there were only two witnesses—and they're both on your side. Merry Christmas to you, Tony." END

Next Month: Gus delves into the mystery of the car that wouldn't turn left.

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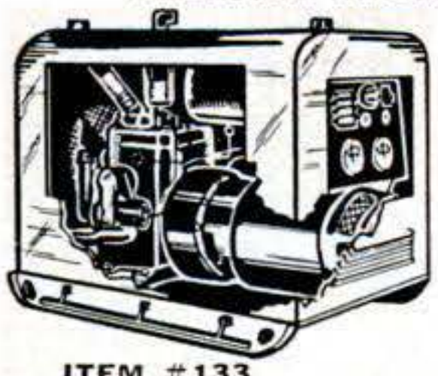

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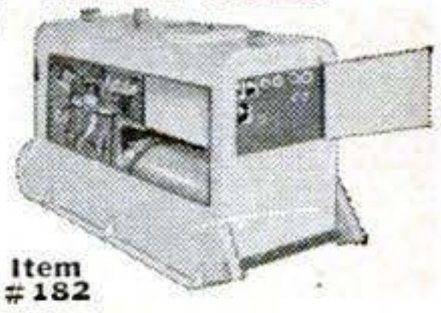

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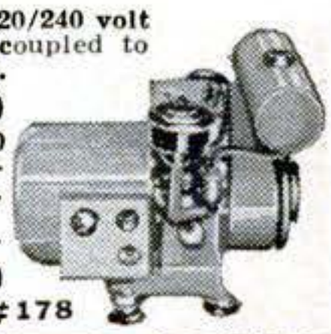
Totally enclosed power unit with 2 cylinder water-cooled Hercules Model BXB engine direct coupled to generator. Magneto ignition, crank start, 4 gallon gas tank, 3 qt. oil capacity. Skid mounted with handrails for carrying. Instrument panel including killer button, oil pressure, water temp. gauges, voltmeter, ammeter. Shipping wt. 560 lbs. F.O.B. Chicago.
Item #133 ..... **395.00**

Write for information on other size generating plants ranging from 350 watts to 25 KVA.

Item #182—Onan Generator—5KW—120/240 volt—60 cycle A.C. single phase, direct coupled to Willy's Jeep 4 cylinder engine. Shpg. Wt. 1200 lbs. F.O.B. Chicago..... **795.00**

Item #178—350 watt—110 volt—60 cycle A.C. direct coupled to 1 cylinder Midco engine. Shpg. Wt. 11 lbs. F.O.B. Chicago..... **125.00**



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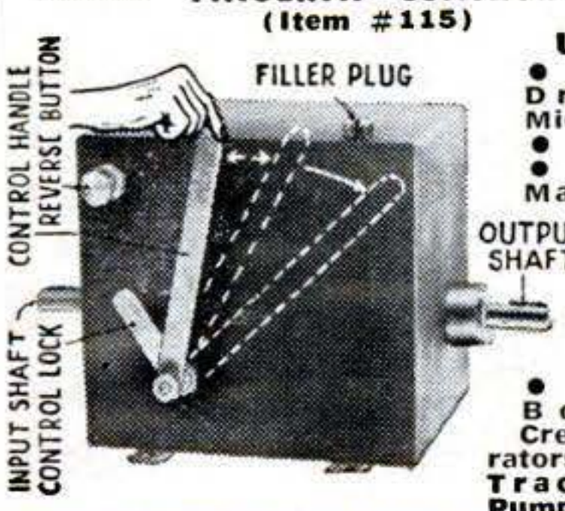

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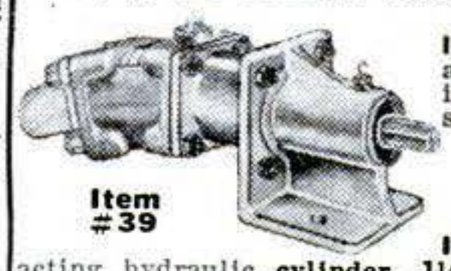

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ITEM #33C—Double action hydraulic cylinder, 1½" bore, 4½" stroke. Clevis mountings at both ends. Uses ¼" pipe fittings. **Postpaid** **8.95**

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ITEM #31C—Double action hydraulic cylinder, 3½" bore, 11" stroke. Aluminum alloy cylinder wall and all steel 1⅛" piston rod. Clevis mounting at base and shaft. 19½" overall length closed. Will lift 9625 lbs. using 1000 PSI from Logan Heavy Duty Hydraulic pump. Uses ⅜" tubing fittings. Value $102.00. Shipping wt. 11 lbs. F.O.B. Chicago **22.50**

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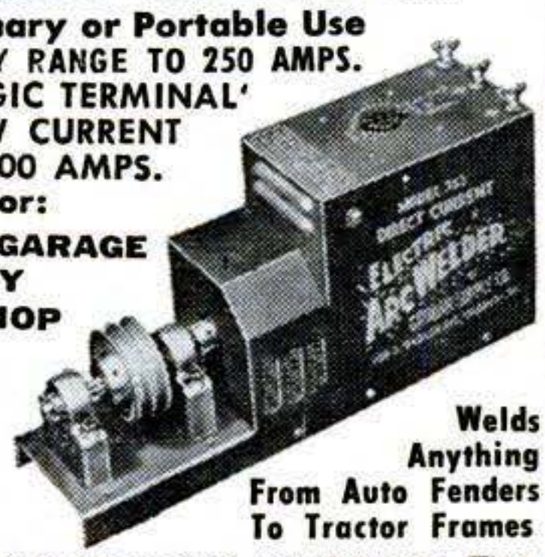

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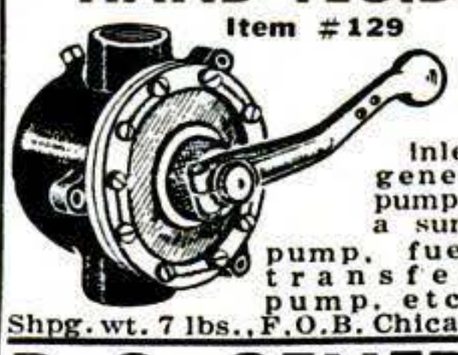

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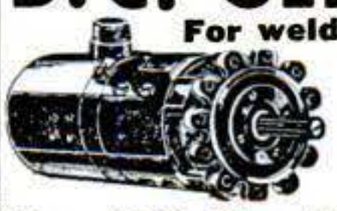

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SYNCRO JIG SAW
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THIN METAL, PLASTIC,
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You, too, can use this amazing new, safe jig saw for fun or profit! Make your own Gifts or to sell! SYNCRO SAW is the most powerful, largest of its kind! QUIET, ideal for apartments. SAFE, blade does NOT pull fingers toward it. NO belts, gears or oiling. Adjustable "any length cut" arm. With BUILT-IN New Reactance Type Electric Motor, $22.95 at dealers or postpaid. World's largest manufacturer of reciprocating electric sanders with double arc motion which gives double the sanding action.

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QUALITY TOOLS
ELECTRIC
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U.S.A. Model No. 201. 60 Cycle, 110-120 Volt AC. Other Voltages, Cycles available.

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☐ ORDER. I enclose $22.95. Send No. 201 Saw postpaid on 10-Day Money Back Trial.

☐ FREE CIRCULAR. Send new SYNCRO CIRCULAR showing amazing new SAW and amazing NEW SANDER.

Coast to Coast in an Old, Old Olds

[*Continued from page 132*]

the Olds had to be hauled in by another car.

The Olds needed repainting in 1909, and again in 1937. Both times it got it. The Olds is black, with a little red trim, and gold striping. The lights are brass. Mr. Green does not do the painting on the Oldsmobiles he restores, but he admires the results. "These cars," he says, "are really beautiful when they're all striped up."

The clincher-type, 28 x 3 tires are not hard to get. Firestone has been making them, has stopped temporarily because of rubber shortages. The tires are less expensive, by Mr. Green's long memory, than they used to be—$20 today, $28 in 1907. The new casings don't crack, either, as the old ones did.

Flats Are a Problem

A flat tire can cause trouble—and it's worse than you might think. This is because the wheels don't have demountable rims. The flat must be pried off.

Next, the new tire has to be wedged onto the rim. Then it must be pumped up by an old hand pump—unless Mr. Green has had his flat right in a service station. He has a flat where things are that convenient as often as you have.

Besides the Olds, Mr. Green owns two other cars. A 1946 Hudson he won as a prize in an old-car contest. He had driven it 8,101 miles by late 1951. A 1932 wire-wheeled Studebaker, the only car he ever bought new, had by then traveled 89,614 miles. It has been dependable, and Mr. Green has never felt the need for turning it in on a later model.

Uses Grandfather's Tools

Mr. Green drove the 1904 Olds to Ohio and back late in 1951. Mrs. Green, who has never driven a car, went along and kept a record of the mileage: 27 miles to a gallon. A passenger on all the long trips, she carries along a Kodak she bought for $5 in 1915 and keeps a photographic record of their jaunts.

In his shop Mr. Green has a 1½-hp. gasoline motor he made in 1902. He still uses some tools, notably hammers, tongs, wrenches and an anvil that his father, a blacksmith, used in the 1890s. Mr. Green also has a hammer that his grandfather, also a blacksmith, forged and used. "When I get anything," Mr. Green says, "I keep it." END

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DELTA POWER TOOLS

What better Christmas bonus, what finer gift, can you imagine for *yourself* than Delta Power Tools? It's a lasting bonus, too, that keeps on paying year after year in pleasure and relaxation and profit —for these quality tools soon pay for themselves in actual money saved on the things you make for yourself, for the home, for the family.

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BASIC TOOL in any workshop, to perform ALL the basic woodworking operations, a Delta circular saw pays for itself in worthwhile home improvements — and pleasure!

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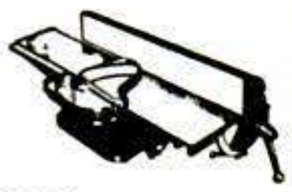
Drill, carve, sand, mortise, shape, rout and grind with this drill press. Does lots of jobs—precision-built to last.



DELTA JOINTER

Eliminates back-breaking work of hand-planing—makes true, smooth edge for precision fit Heavy duty.

DELTA BAND SAW

Big capacity band saw cuts wood up to 6" thickness, curved or straight line cutting to make valance boards, etc.

DELTA SCROLL SAW

This safe machine does almost any kind of sawing. Cuts wood, plywood, plastic or metal in attractive, intricate shapes.

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For the House:	For the Children:		For the Family:
Kitchen Snack Bar	Trucks	Pull Toys	Men's Wardrobes
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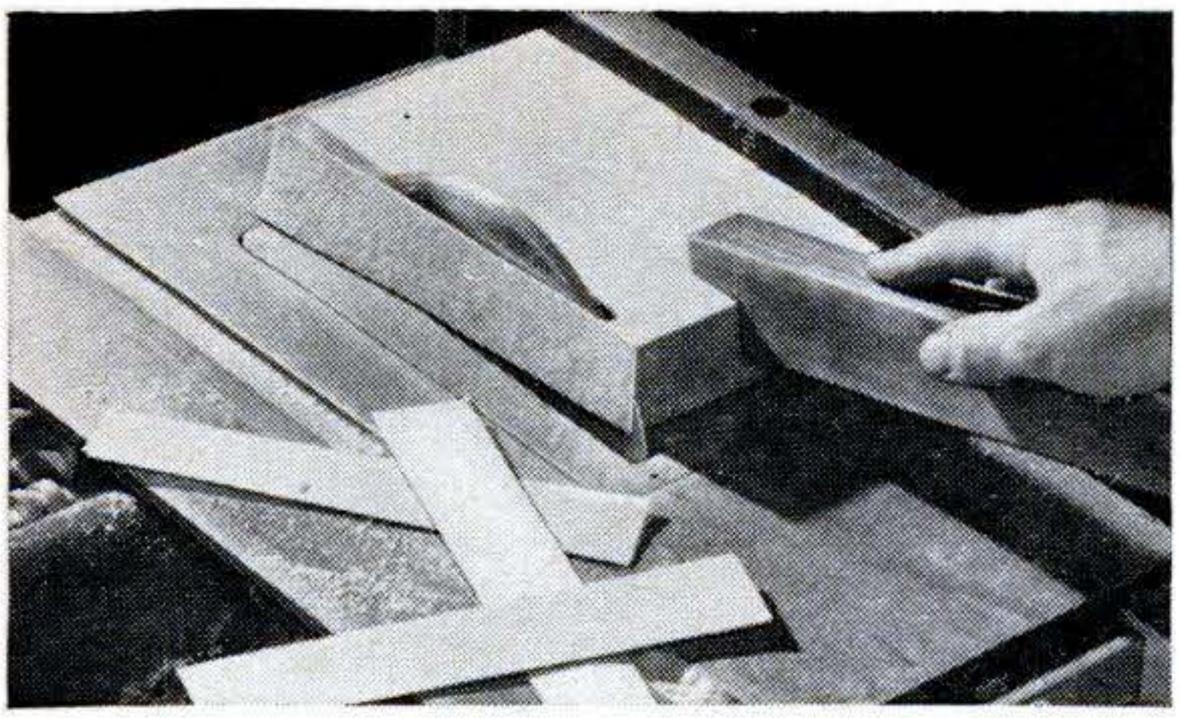
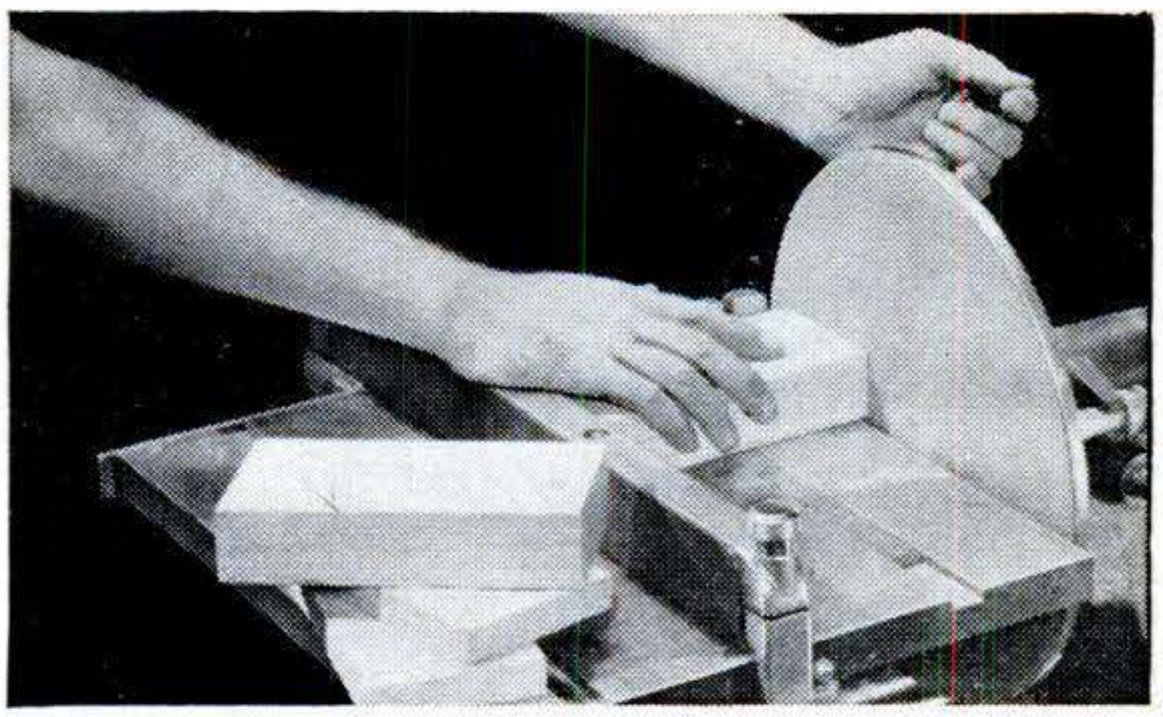
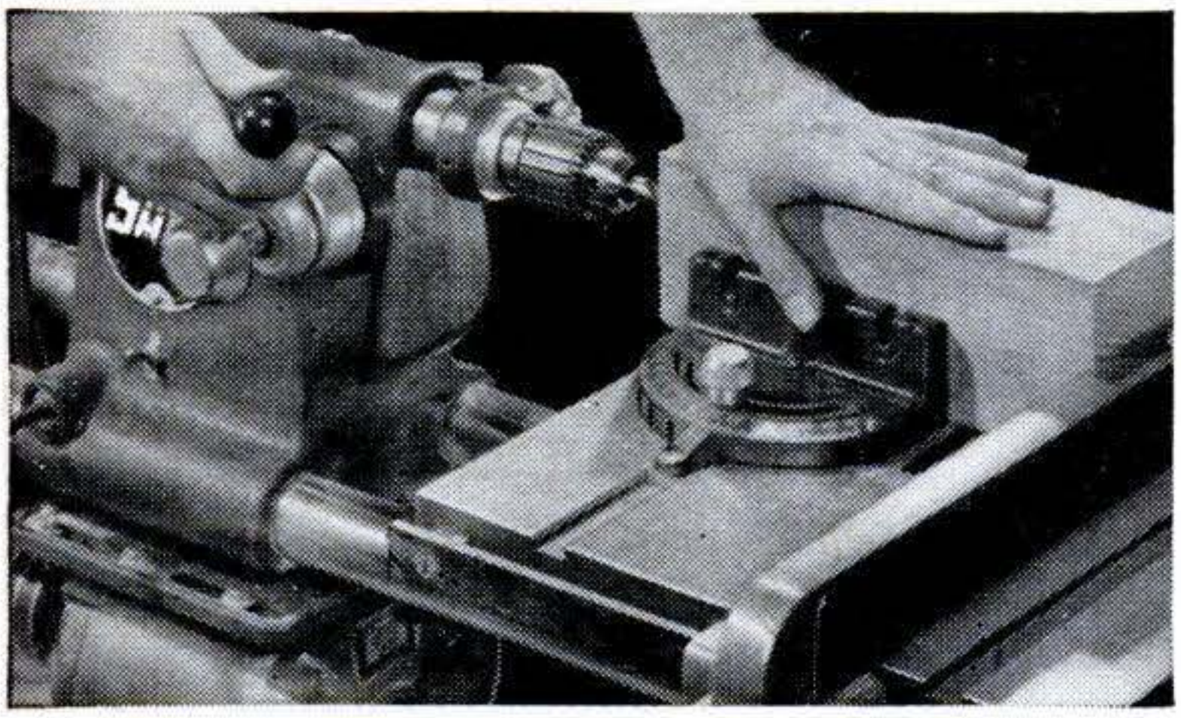


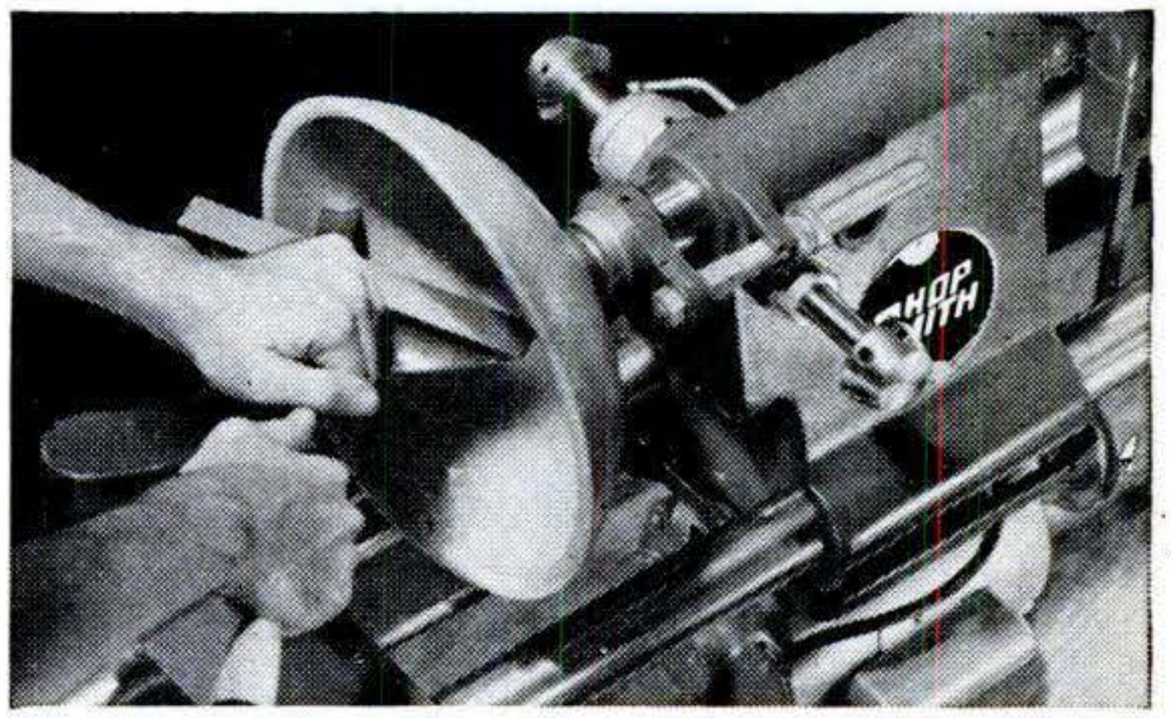
1 "**THIN STRIPS** sawed from scrap lumber can be woven into attractive place mats. SHOPSMITH'S unique micro-quill adjustment permits extremely accurate blade-to-fence settings. Saw takes extra-big work, thanks to unique table extension."



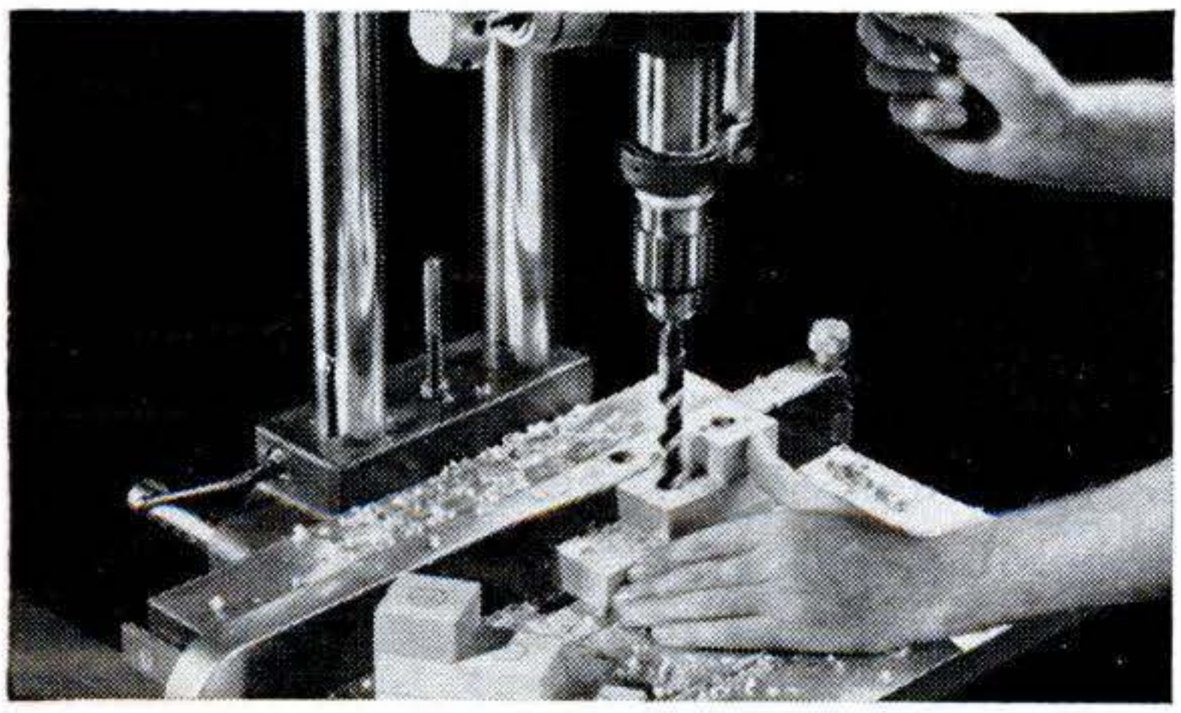
2 "**CHILDREN'S BLOCKS** are easy to make on SHOPSMITH. After blocks are sawed, they can be sanded to identical lengths by setting stop-depth nuts and feeding disc into work. Rip fence and miter gauge serve as accurate jigs for a host of sanding jobs."



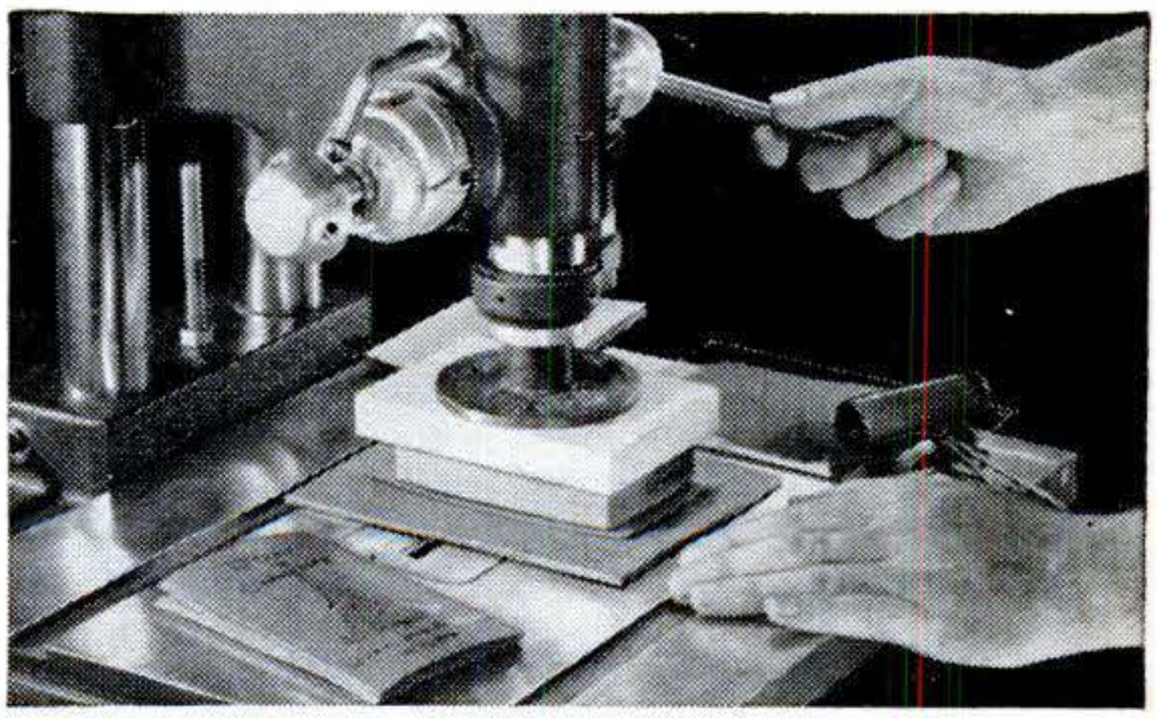
3 "**DRILLING LAMP BASE** shows advantages of SHOPSMITH as horizontal drill. Work lays flat on table. Drill feeds in from side. Horizontal drill has unlimited workpiece capacity, 4" quill feed, variable speeds. Spindle floats on *four* sets of ball bearings."



4 "**SHOPSMITH AS LATHE** turns work up to 15" in diameter, 33" long. Sliding headstock to end of unit lets you face the work while turning bowls and other flat or hollow objects. Versatile tool rest adjusts quickly, slides parallel to workpiece."



5 "**IN VERTICAL POSITION,** SHOPSMITH becomes a drill press second to none. Its maximum chuck to table clearance is 27"; chuck to floor, 55". Extra-large, tilting table. Jacobs key chuck, 5/64" to ½", is standard equipment. Speeds from 800 to 3600 rpm."



6 "**IT'S A PRINTING PRESS, TOO.** We found SHOPSMITH ideal for printing our linoleum block Christmas cards. In fact, there's almost no limit to the things you can do with SHOPSMITH. And you've never seen a tool that is more beautifully engineered."

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Dept. 190-A
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in Gala Christmas Boxes*

● Gifts that are practical, that are useful *and useful for years*—gifts that are sure to win lasting appreciation... surely, *these* express the true spirit of Christmas. And your hardware retailer has them—the finest saws ever manufactured—genuine Atkins *"Silver Steel"* saws, packed in individual Christmas boxes*. Here are saws that put that sparkle of satisfaction into the eyes of men and boys alike—saws that are known the world over for their exceptional quality and value! Hand-crafted, precision-built saws that cut fast and true, that stay sharp longer and are easier to handle! To give Atkins is to give the *finest*, yet to stay within limits of your Christmas budget.

● **ATKINS** *"Silver Steel"* **FILES**—Tough, long-lasting, dependable—outstanding in quality and value!

*if your retailer is sold out of these special boxes, he will gladly supply any Atkins saw in Christmas gift wrapping.

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ATKINS

ATKINS

World's Fastest Freight-Train Factory

[Continued from page 116]

ahead begin to move up the long artificial grade at a steady, two-mile-per-hour gait.

At the base of the signal light, a yard conductor consults his copy of the teletyped switch list as the cars begin to roll past. He sees that the first three are bound for Potomac Yard. He gives a sign to his helper, who opens up the couplers between cars three and four by dropping the release bar as they go by. The three-car "cut" tips the hill and breaks away, accelerated by the pull of gravity.

Tower Operators Control the Brakes

But let those three cars go on gaining momentum and they will hurl themselves into the classification yard like a 150-ton blockbuster. That's where the trickiest operation in the entire terminal comes in—electropneumatic car retarding.

Picture the trunk of a tree (the descending approach track), forking into three branches, each of which divides into two more. Along a section of each running rail on the trunk, and on every one of the nine branches, is a viselike pair of jaws, operated by electrically controlled compressed air, that rise up and grip the wheels of the cars as they pass over them. These are called retarders.

The nerve centers of the layout are three towers, standing like oversize birdhouses high above the diverging tracks. Here, operators sit at their desk-top control panels, pinching down the tonnage. Each retarder has its own dial with four settings: Number 1 for empties, Number 2 for light loads, Number 3 for the heavy ones, and Number 4—an emergency setting that will throw a 90-ton gondola car back on its haunches.

Flatcar Is Frisky as a Colt

12:40 finds Boston & Maine 33509, with the humping engine behind her, poised at the top of the hill. The operator of *A* Tower, who controls the master retarders and shoots cars passing through them on to *B* and *C* Towers, sends her on her way into *B* Tower territory with just a touch of the retarders.

But neither he nor *B* Tower has reckoned on the erratic behavior of our flatcar. As sometimes happens, the hot oil shot into her journal boxes just before she tipped the hump has made her as frisky as a colt. She sails into Track 16 (Jersey City) with

[Continued on page 264]

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(Item 72)

SNOW-BLO

The sensational device that makes snow removal real fun. Easy — a child can operate it. Safely guarded whirling impeller quickly scoops up the snow and blows it 25' either side. Big timesaver. Clears driveways and walks in a jiffy. Eliminates dangerous exhaustion and overtaxed heart, which kills so many every winter. BOYS! Make big money clearing snow for neighbors. Easily converted to lawn mower when desired. New silent electric model powered by ½ hp. motor clears 16" swath. Complete with shockproof 100' cord (Item 72)... **$139.50**

Gasoline Model with easy starting 2 hp. 4 cycle engine (Item 73)... **$159.50**

Self Propelled Model for large areas (2½ hp. engine) (Item 74)..... **$229.50**

With 5 hp. engine (Item 75) **$269.50**

We pay freight on Snow-Blos.

FREE with purchase of any model, an extra 100' extension cord.

ANGLE DRILL

(Item 23) Fits into chuck of any electric or pneumatic drill or flex. shaft. **Operates at any angle in a full 360° arc.** Makes possible drilling, grinding, carving, routing, etc. in close cramped quarters. Makes impossible jobs easy. Made by Kett Tool Co. Complete with built-in chuck (¼" capacity) and adjusting key. Hardened alloy gears. Precision built for heavy duty. Lists at $39.95—while they last.... **$9.95**

GEM CUTTER

(Item 49) Complete Prof. Lapidary mach. for cutting, shaping, grinding and polishing precious and semi-precious stones. Precision built with big horiz. power driven gem cutter, built-in cutting lubricator; genuine 6" supercharged diamond saw, lap wheel, abras. whls., 2 scratch whls., 4 felt whls., grinding and polishing compounds, brushes, dop cement and sticks, cutting oil, ext. cord, asstd. gems, complete instructions. Requires ¼ hp. motor (not incl.). Wt. 22 lbs. Worth $99.50. Our Special..... **$39.95**

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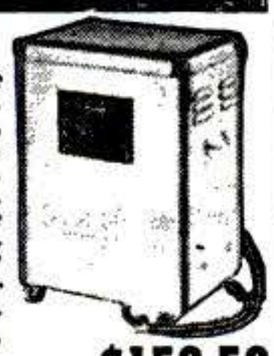

(Item 168) Master Hi-Line A-C Arc Welder. **20-190** amp. output. Welds or cuts iron, steel, brass, etc. from 24 gauge to 5/8" with single pass. Operates from 220/230 V. 50/60 Cycle A-C line. None better. Meets REA requirements. Handles 1/16" to ¼" rods. Adjustable output for any job. In sturdy steel cabinet, on casters. Full instru. and 1 yr. guar. incl. Wt. 210 lbs. Reg. $250 value..... **$159.50**

(Item 169) 20-100 amp. A-C Welder operates on 110 or 220 V. Wt. 65 lbs. Worth $125 ..... **$64.95**

(Item 181) Welding Kit incl. helmet, 2 leads, electrode holder, ground clamp, power cord and rods (sold only with welder) Wt. 12 lbs. **$12.50**

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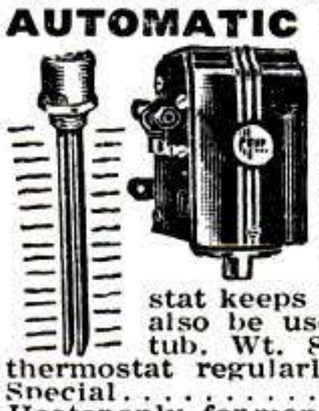

(Item 76) Immersion type 115 v. AC—1250 watts. Convert your present tank to modern automatic hot water heater. Long life Westinghouse or Chromalox element screws into std. 1¼ in. opening in tank. Adjustable thermostat keeps water at desired temp. Can also be used in washing machine or tub. Wt. 8 lbs. Heater element and thermostat regularly $49.50 Special..... **$14.95**

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(Item 25) Air-cooled, 1½-2 h.p. Complete with gas filter, air cleaner, governor, fuel tank. Ready to run. Speed range 2000-3600 r.p.m. 5/8" shaft. Rope start. Ideal for pumps, air compressors, power tools, generators, etc. Factory warranty and instructions incl. One of the best made. Wt. 40 lbs. Worth $72.50. Special... **$46.50**

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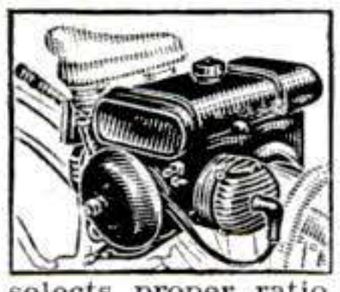

COMMANDO BIKE MOTOR

(Item 90) New, super-modern 1952 model. This job is the Cadillac of all bike motors. Sensational Auto-Clutch prevents killing motor at each stop. Also selects proper ratio on hills. Mounts behind and drives rear wheel with Dynarotor. Free Wheeling lever permits pedalling if desired. Rear Mounting eliminates fumes, heat, dirt, and hard steering. Easily installed in 15 minutes with home tools. Sturdy, trouble-free, easy starting, light weight. Airplane type engine; up to 150 miles per gallon. Fully guar. Ride for fun or profit. Ideal for deliveries, paper routes, messenger service, etc. Ride to work and save.

The Commando Captain, 1 cylinder 1½ hp. **$99.75**

The Commando General, 2 cylinder 3 hp. (Item 91)..... **$125.00**

All Commandos shipped prepaid in U.S.

½" DRILL

Removable handle

(Item 33) DeLuxe model —powerful, smooth running, precision built. Handles toughest jobs. Cutler-Hammer switch, **Jacobs** key chuck. 110-120 v. AC-DC 300-450 rpm. Alum. alloy case for high strength and easy handling. Built-in blower assures cool operation. Cap. ½" in steel. 1 year written guar. Wt. 11 lbs. Should be $65. Special..... **$34.50**

8" TILTING ARBOR SAW

Terrific Value. Heavy duty 5/8" double ball-bearing arbor. Saw blade tilts, table remains level. Big 12"x16" precision ground table. (Extensions to 24"x16" avail.) Micrometer hand wheel controls tilt and depth—2½" cut. Cross-cutting, ripping, dadoing, sanding, bevel and angle cutting, all easily performed. Essential for all cabinet work. Motor carriage, mitre-gauge, rip-fence, splitter, guard and blade incl. Compares with saws selling at $89.50. DeLuxe Ball-Bearing model (Item 69) wt. 34 lbs..... **$44.95**

Bronze-bearing model (Item 70) ½" arbor, table 10"x13", wt. 34 lbs.... **$27.50**

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World's Fastest Freight-Train Factory

[Continued from page 262]

every intention of dashing herself to splinters against the string of cars being put together there.

"I'll give her a skate!" yells *B* Tower.

Down beside Track 16 stands a small rectangular box with a two-pronged arm projecting toward the left-hand rail. Cradled in the arm is a husky casting shaped like a miniature ramp, with a wheelstop at one end. Up goes the fork, and the casting, or *skate*, sits neatly on the rail, directly in the path of the careening 33509. The car's left forward wheel gives a sudden leap and comes to rest atop the skate. There's a squeal of iron on steel as the casting slides ahead with just enough friction to tie the flatcar down in the span of a hundred feet.

5,600 Tons for Jersey City

That's the last of the string of cars from Altoona. Already the hump light has flashed from yellow to intermittent red, high-signing the engine to back out of the way of the next train coming down. A Williamsport freight, with her 14 contributions to Track 16, will finish out the Jersey City lane. A quick switching move and the cars will be brought together for coupling and connection of the air hoses.

1:15. A phone jangles in the engine dispatcher's office.

"Yardmaster calling. I've got one hundred and twenty loads for J.C. Tonnage: 5,600."

"Okay. We'll give them Motor 4863."

An engine hostler climbs up into the cab of the 4,620-horsepower GG-1 electric locomotive. Her rear pantograph makes contact with 11,000 volts and she's on her way to an almost noiseless coupling with the fast freight for Jersey City. Down from a gravity track, behind, comes a caboose to round out the hotshot. She's just about ready to roll.

Enola Is Too Fast for Conductor

It takes 12 minutes to charge the air-brake system to 80-pound pressure, and while the conductor is waiting he skims his new set of wheel reports. Suddenly he stops.

"B & M 33509!" he exclaims in disgust. "Now I'll be a trainmaster's uncle if we don't have trouble on this run. Why couldn't they send her off in the wrong direction like every other yard in the country? But, no—they gotta put her through in an hour and 50 minutes just to foul up my afternoon. That's Enola for you!" END

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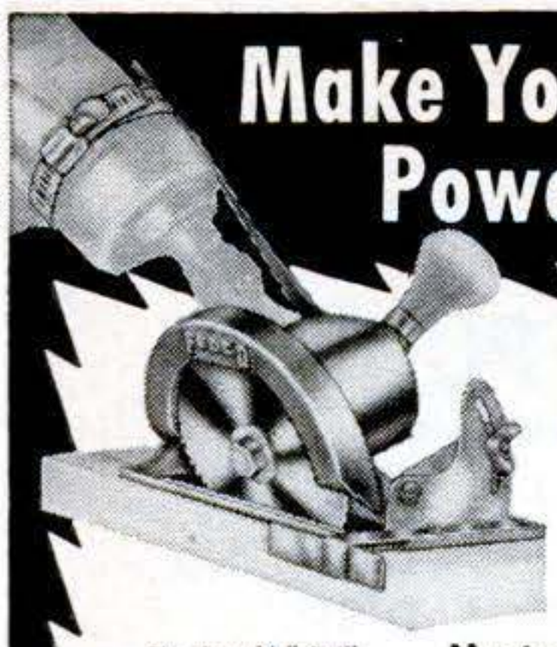
Make Your Drill a Power Saw with



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Complete with Combination 4-inch Blade and Bevel-Tilt Ripgage. Fully Adjustable.

Most popular tool of its kind . . . zips through wood, plastics, wallboard, etc.

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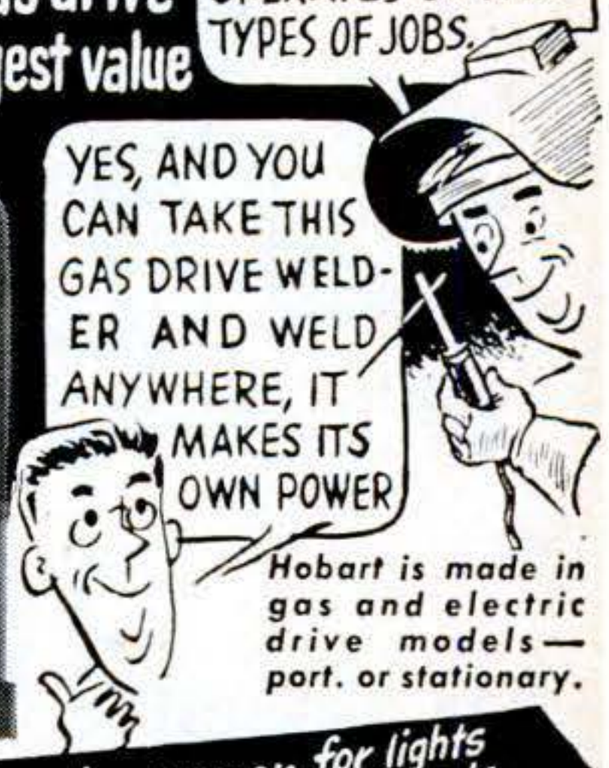

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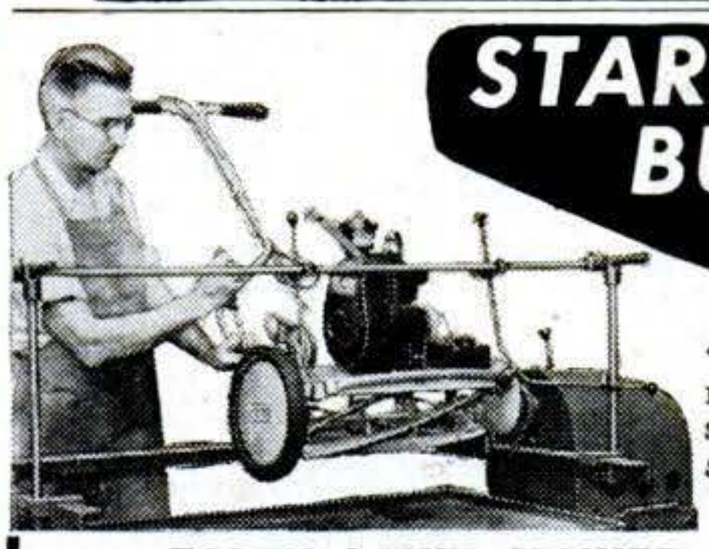

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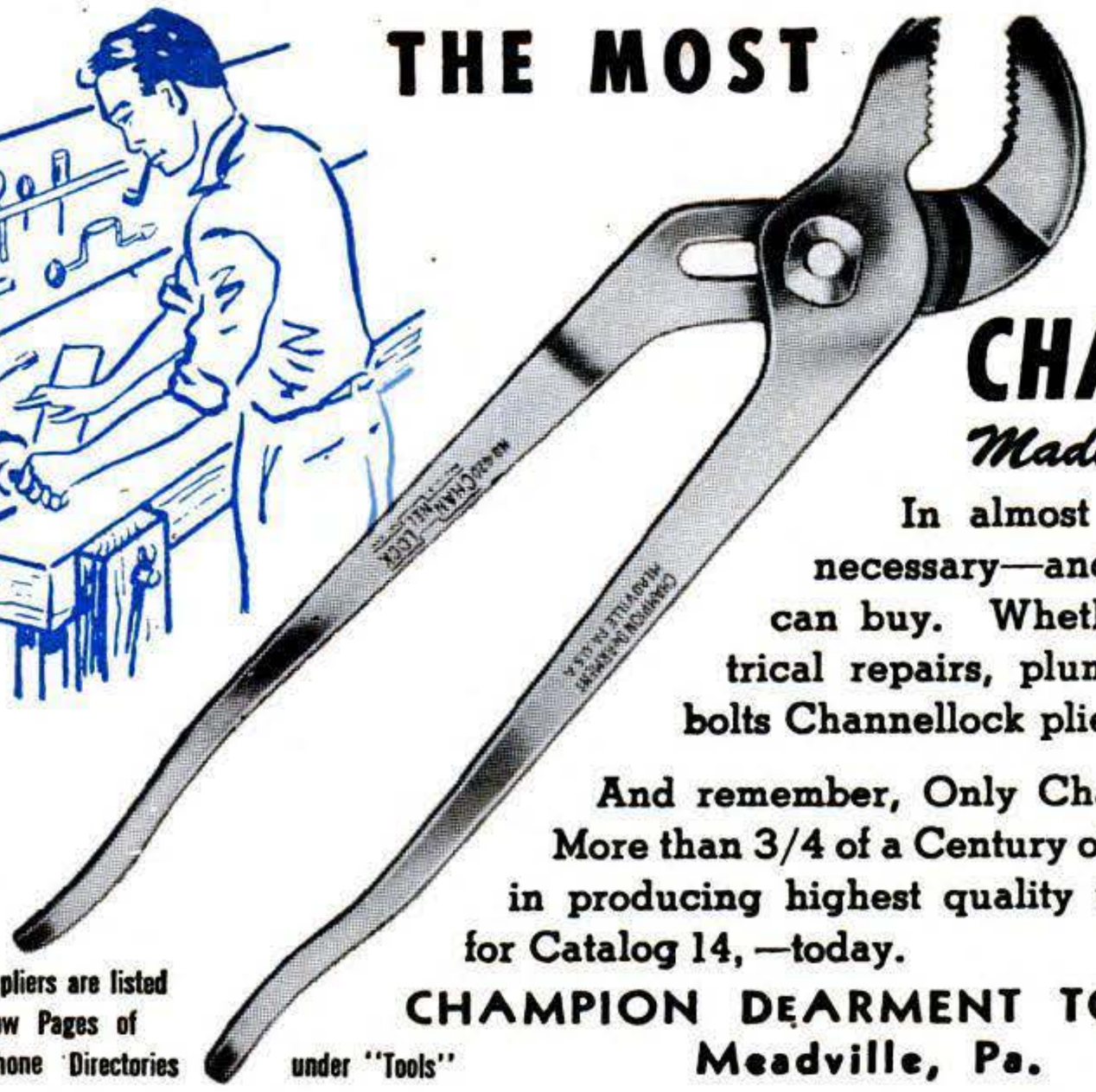

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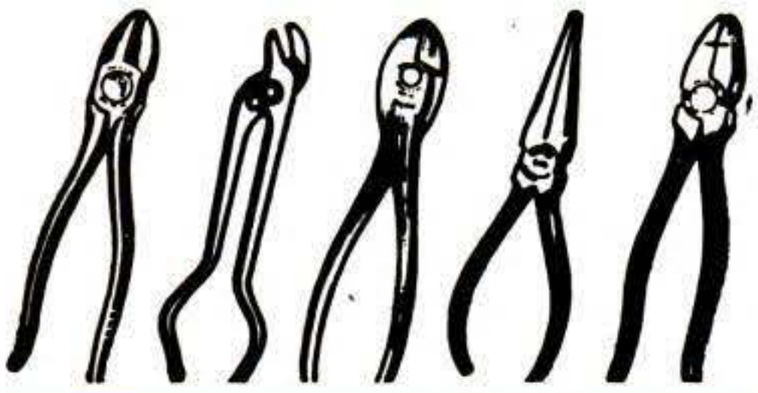

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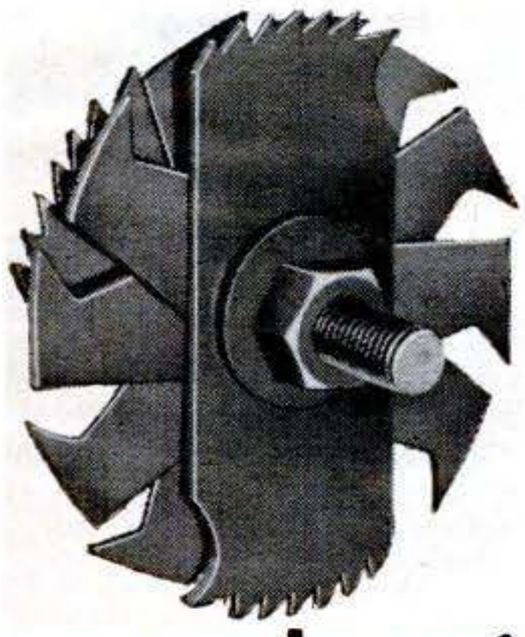

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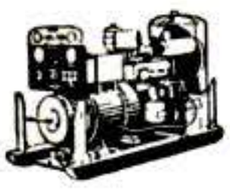

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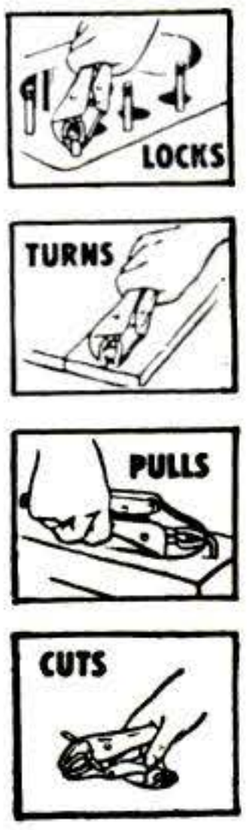

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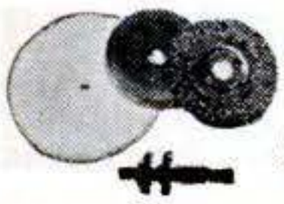

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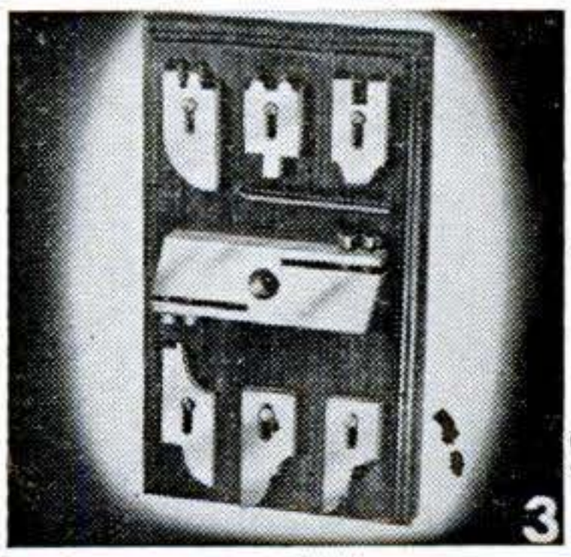

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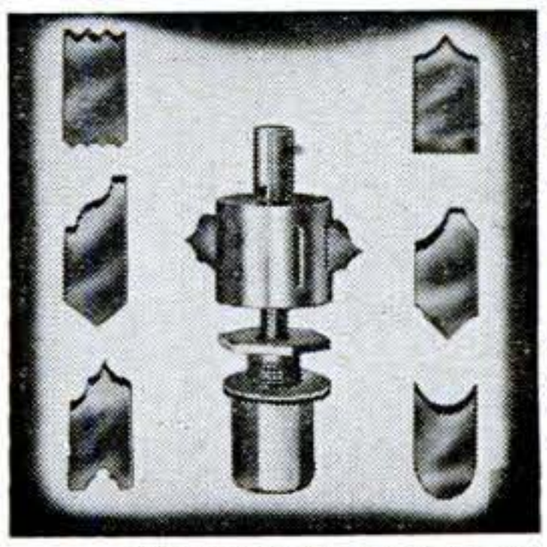

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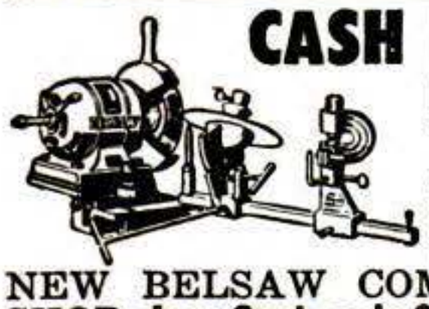

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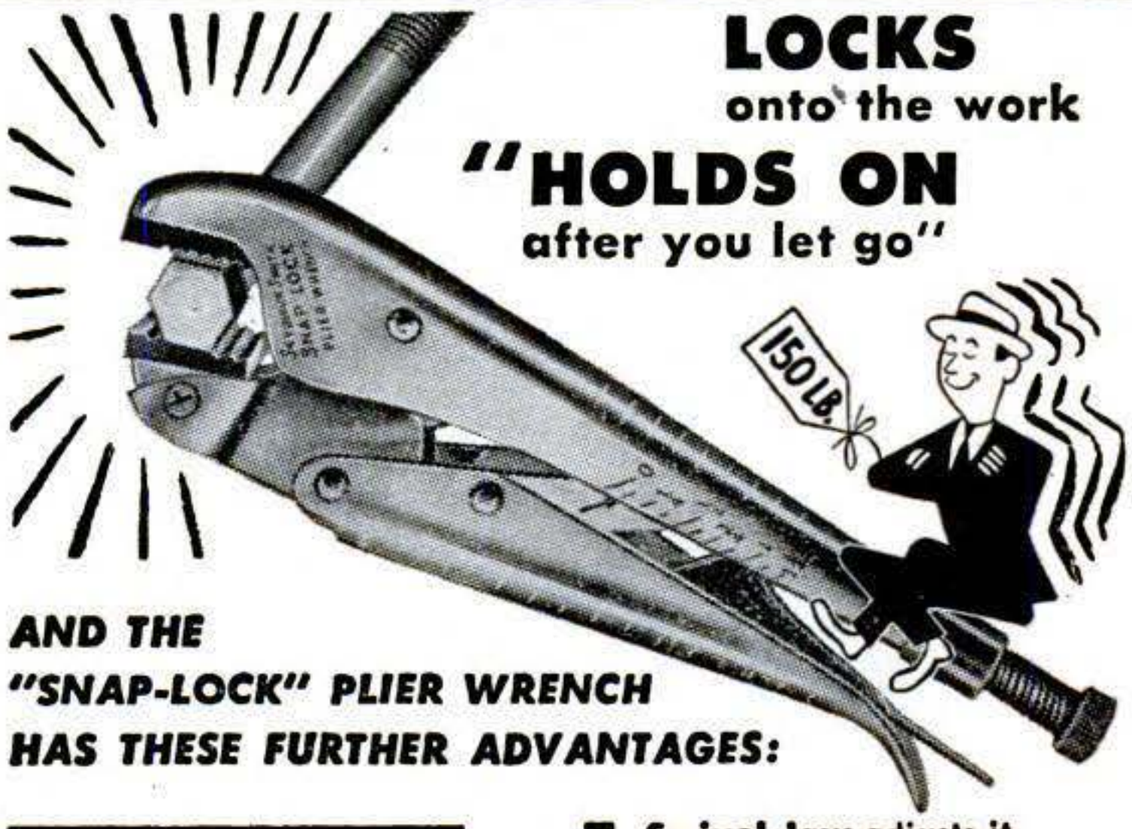

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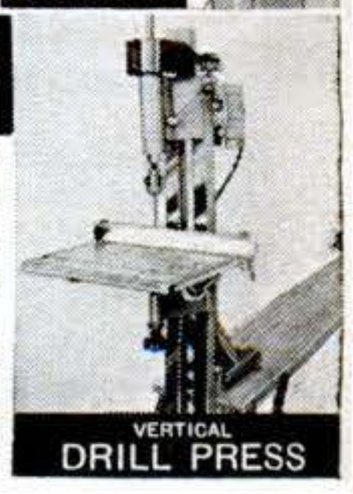

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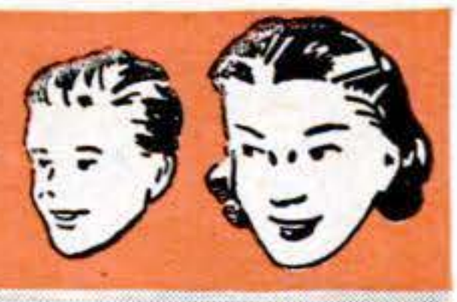

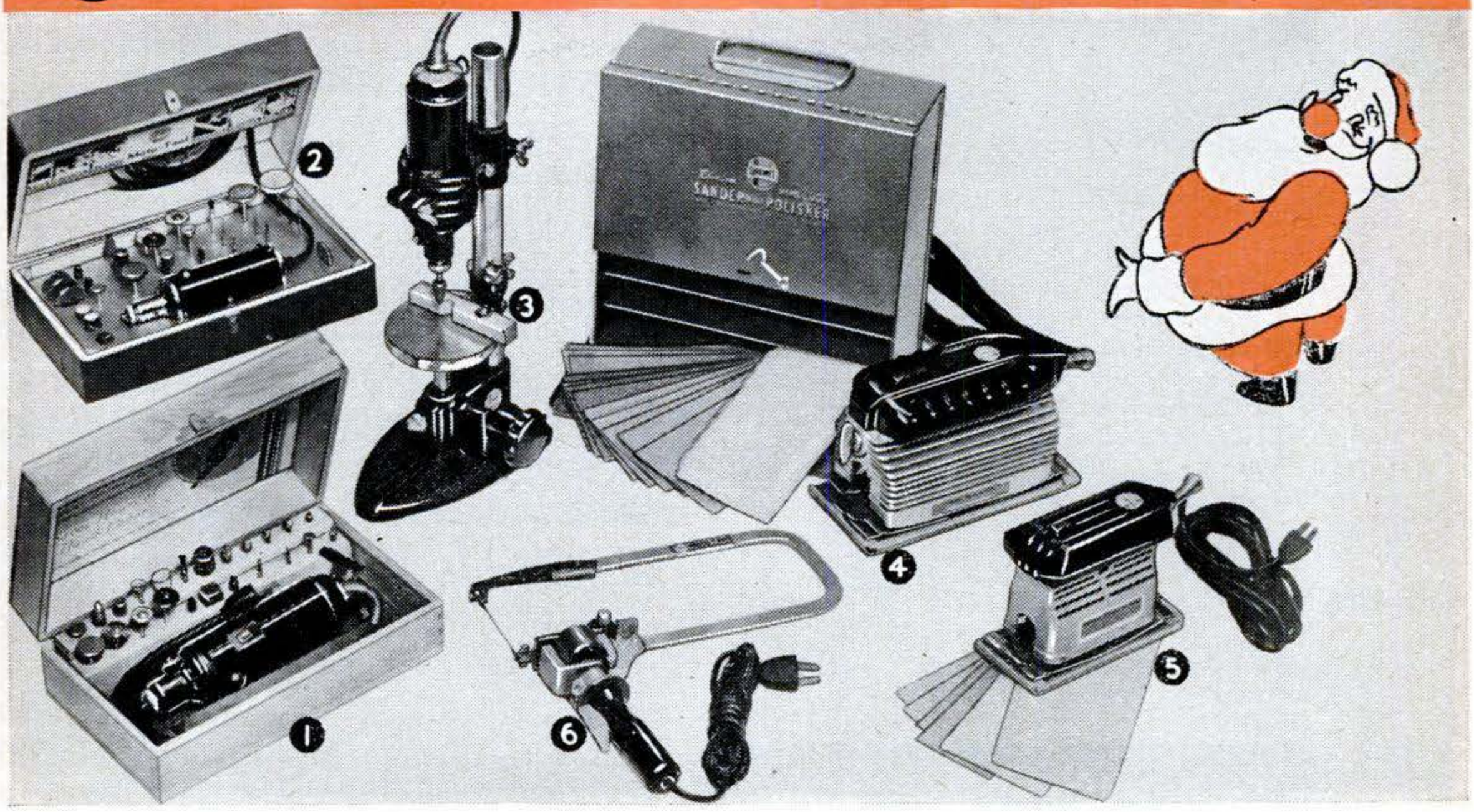

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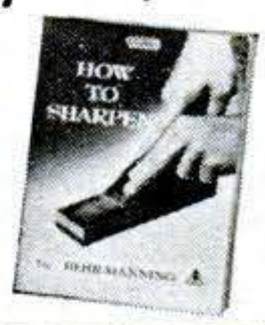

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CUTS 1-5/16" or 2x4 by turning over

FEATURES: **Safety-yoke** assures rigid connection and **absolute safety. Visual guide and wide shoe-plate** for straight, square cuts. **Big handle** affords firm grip for two hand operation. **Precision one-piece** gear box. **Self-lubricating** lifetime bearings.

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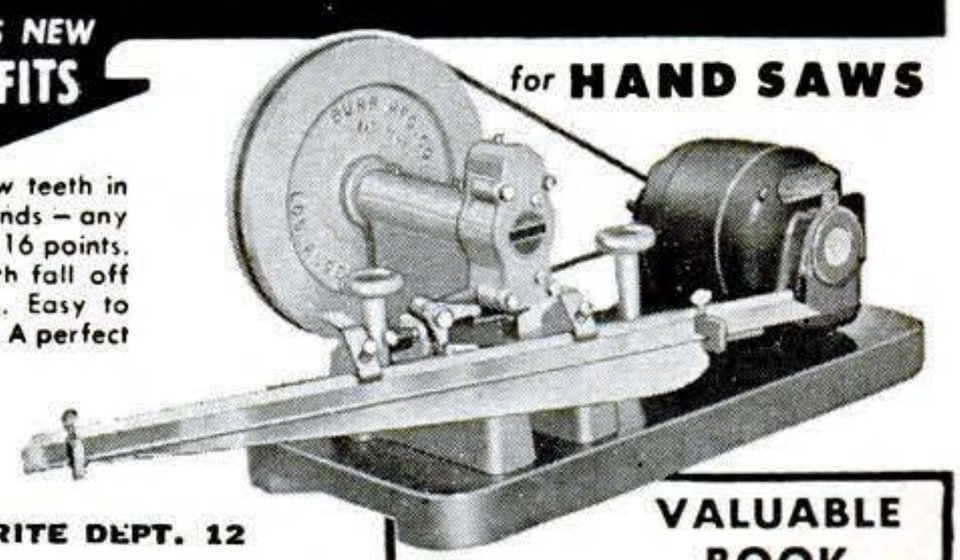

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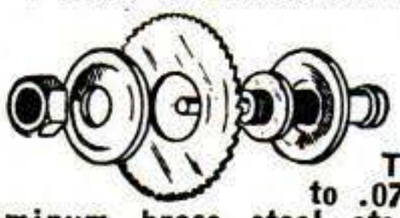
60° Angle of Countersink

SIZE	DRILL SIZE	BODY	EACH
C2	1/16	13/64	$0.49
E1	3/32	3/10	.49
F1	5/32	7/16	.69
F2	3/16	7/16	.69

5% discount for purchase of 1 doz. of any size or mixture of above.

4 H. S. SLITTING SAWS WITH MANDREL



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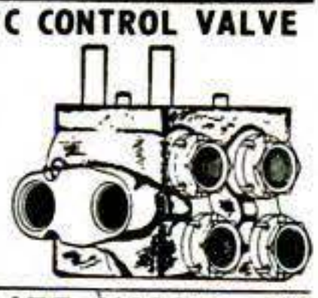

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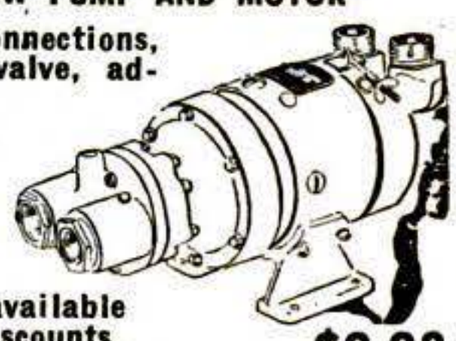

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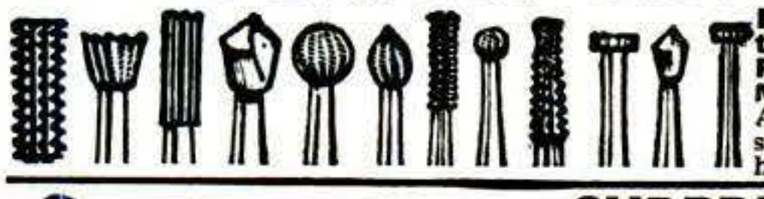

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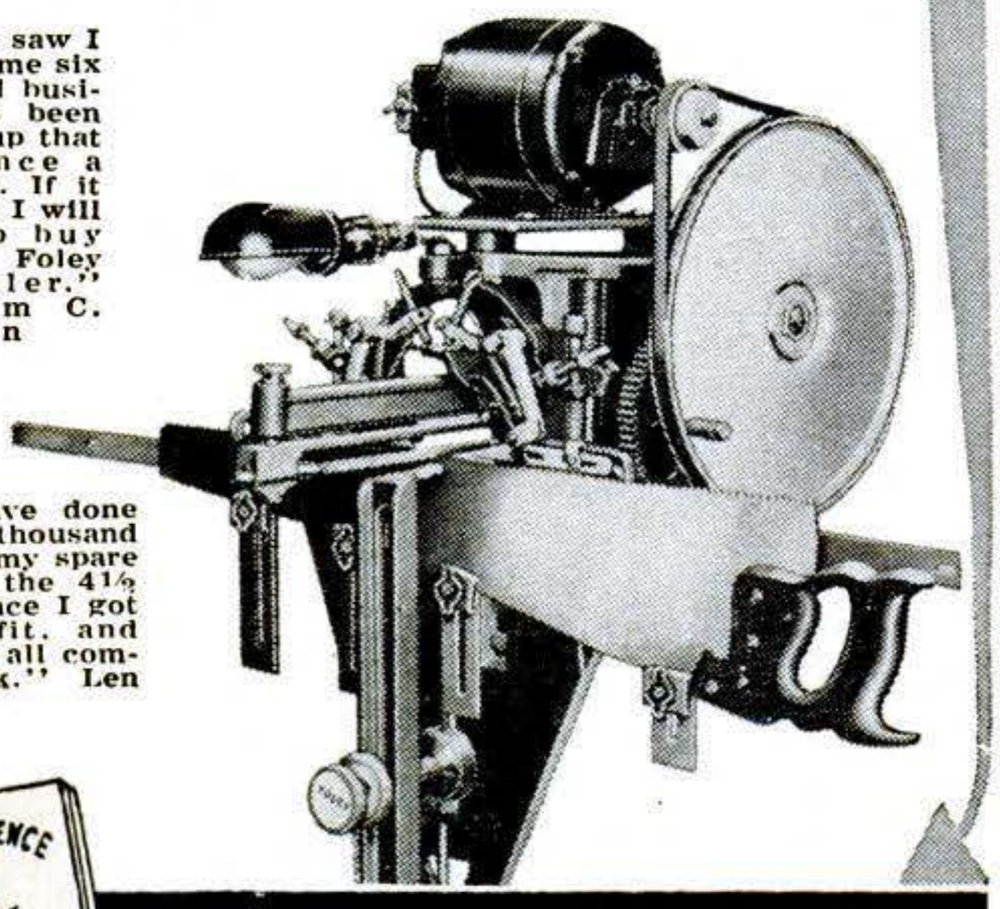
"Each saw I filed got me six more and business has been picking up that way since a year ago. If it keeps up I will have to buy another Foley Saw Filer." William C. Baldwin



"I have done 4 or 5 thousand saws in my spare time in the 4½ years since I got the outfit, and they are all coming back." Len Crego

SEND COUPON FOR FREE BOOK

FOLEY MFG. CO., 1219-1 Foley Bldg.
Minneapolis 18, Minnesota

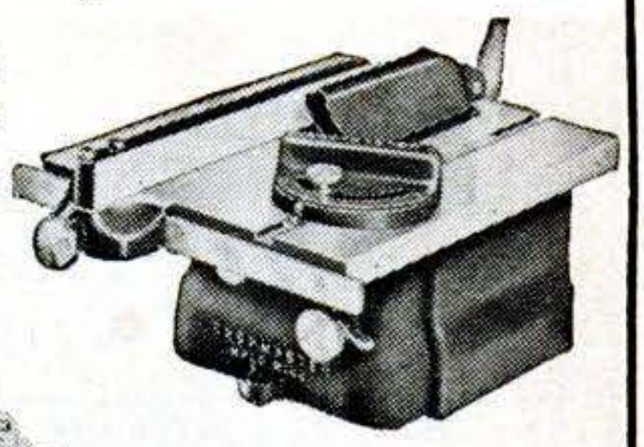
Send FREE BOOK—
"Independence After 40."

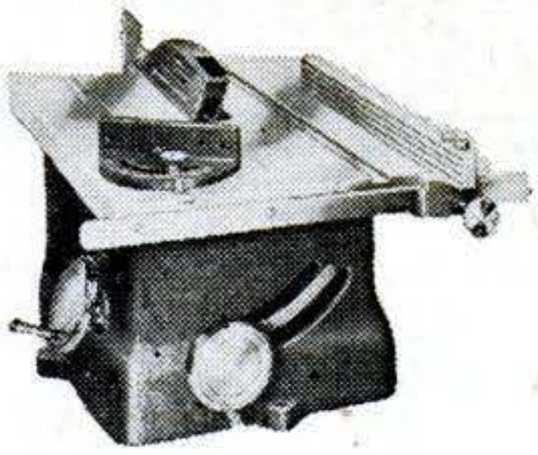
Name.....

Address.....

A SHOPMASTER Circle Saw ...for any Purpose or Price

A Shopmaster Circle Saw is known for its ruggedness and precision.
7" Tilting Arbor Saw **$47.95**





Satisfaction guaranteed.
8" Tilting Table Saw **$51.51**
7" Tilting Table Saw **$33.95**
All Prices Zone 2, slightly lower in Zone 1

Large working surfaces on all Shopmaster Saws.
8" Tilting Arbor Saw **$76.95**
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10" Floor Model...**$105.00**

Write today for catalog of *COMPLETE* line

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Make Your Own

POWER LAWN MOWER

with this DRIVE CUTTER ASSEMBLY

Constructed for those who desire to build their own mower or to replace your old cutter assembly. Complete with 18" blade and double ball bearing drive, only..... **$12.95**

Add 50c to cover handling & shipping. No COD's

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PALMGREN "HOBB-E" Rotary, Index, Milling Table

Ideal for Model Parts or Shop Work

Mill-Grind-Drill-Index-Rout curved or straight-Rabbet and Mortise on drill press or lathe. 8" Table, 4" Cross Feed, 360° Rotation, Accurately Graduated. Bolts to table. Order NOW! SAVE $100. Only **$54.50.** Less Rotary Feed **$43.75.** Write for **"HOBB-E"** Tool Circular.

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DYNAMIC POWER TOOL COMBINATION

INCLUDES: Cummins ¼" Electric Drill; Cummins Saw Attachment; Combination Saw Blade; Set of Drills; Lambs Wool Bonnet; 6 Sanding Disks; Steel Arbor and Attachments; Cloth Buffing Wheels; Grinding Wheel; Wire Wheel Brush; Steel Paint Mixer; Steel Bench Stand; Portable Steel Carrying Case.

Price of Dynamic Power Tool Combination complete is $26.95

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Try it ten days before you buy. If completely satisfied then send $2.95 and pay balance at rate of $4.00 per month for 6 months—No Interest or Carrying Charges Added. If not completely satisfied, return to us, no explanation necessary.

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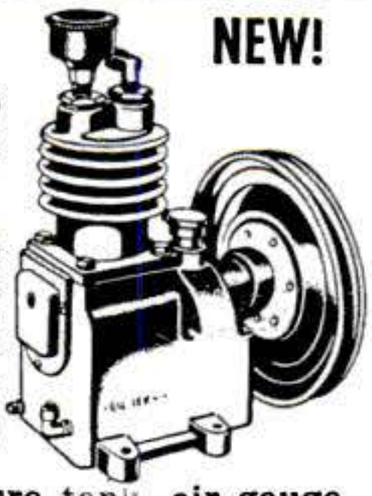
WELLWORTH AIR COMPRESSOR



NEW!

For Farm and Home Workshop

Compressor has 2" bore, 1¾" stroke, 2.8 cfm up to 150 lb. pressure. Motor required: ¼ h.p. at 100 lbs.; ⅓ h.p. at 125 lbs.; ½ h.p. at 150 lbs. or equivalent gas engine. V-belt drive, intake muffler and cleaner, bronze bearings, splash lubrication. Wt. 16 lbs. Replacement parts always available..... **$20.50**

COMPLETE OUTFIT. Compressor, pressure tank, air gauge, air chuck, 20 ft. hose, pop valve, copper tubing with 4 brass flared fittings for connecting compressor to tank, 4-way cross and 3 nipples. COMPLETE OUTFIT. wt. 30 lbs. **$32.45**

Equipment less compressor **$12.45**
Tank only, $6.25

All Brand New Equipment

Wellworth COMPRESSOR BUY

1 YEAR GUARANTEE

FEATURES

2 compression and one oil ring, aluminum alloy connecting rod. Stainless steel valves with brass seats and retainers. Cool-flo cylinder head, spray mist lubrication to every moving part. 10¼" V groove fly wheel for ⅝" B section belt.

Model W3

2½" x 2". 2.55 to 4.80 c.f.m. up to 150 lb. pressure. Operates with ⅓—½—¾—HP Motor. Special Price. **$27.95**
Shipping wt. 24 lbs.

Model W7

2 cylinder 2½" x 2". 5.10 to 8.50 c.f.m. up to150 lb. pressure. Operates with ½—¾—1½ HP motor. Special Price..... **$54.50**
Shipping wt. 45 lbs.

WELLWORTH V-BELT CLUTCH

BRAND NEW

Takes starting load off engines or motors. When speed is reached, a flip of handle shifts clutch from idling to driving position. Handles "A" belts, 2.35" pitch diameter, ⅝" bore. Ideal for use with lawn mowers, garden tractors, home workshop motors, etc. 3¼" long. Safe, easy to mount, sealed bronze bearings, positive action. Shpg. wt. 3 lbs. **$7.50**

BUSHING FOR ½" SHAFT 15c

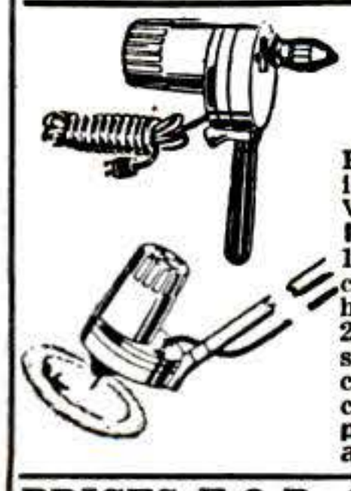
"WELLWORTH" BLOWER BARGAIN

BRAND NEW. Quiet operating. Double wheel inlet, double width blower. For heating, ventilating, cooling, air washing, exhausting and forced draft. DIMENSIONS: 10" wheel; outlet 13⅛" x 11⅜"; inlet 8¾". Height 19". Width 18". Depth 16½". C.F.M. ¼" S.P. 1600; outlet vel. 1575. Wt. 45 lbs.

BLOWER LESS MOTOR AND DRIVE..... **$27.50**

With belt and variable speed pulleys, $2.50

Special price to dealers in lots of 5 or more. Write us.



Save $10.00 On A

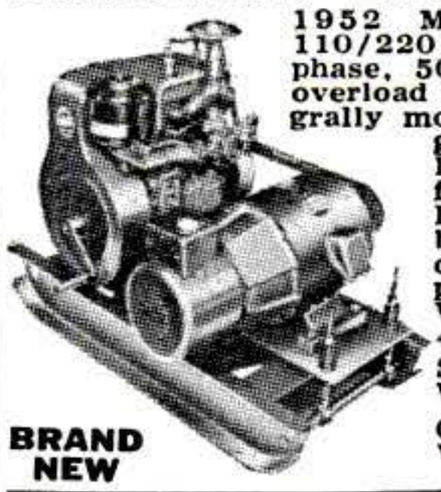
DRILL-O-MATIC

Electric Polisher and ¼" Drill

Polishes floors, furniture, automobiles; does sanding, drilling, and buffing jobs. Handy family Work-Aid. Limited number available. Act fast. **IDEAL GIFT.** Drill and Polisher combination. 110 Volt AC-DC. Disc Polishing Bonnet; ¼" Jacobs chuck; horizontal bench stand; 42" polishing handle; wire wheel brush, 2-mounted wheels; 2-drill bits; spindle adaptor, buffing wheel, 6-abrasive discs; 1-grinding wheel; paint mixer; 12 ft. cord & plug; drill handle; steel hinged carrying case with handle and lock clamp. Wt. 9 lbs. **24 pieces.** Ideal gift. **50,000 were sold at $28.95. Our special price, only $14.95**

PRICES F.O.B. CHICAGO. MONEY BACK GUARANTEE. SEND CHECK OR MONEY ORDER TODAY. PROMPT SHIPMENT. **WRITE FOR CATALOG. SEND 10c FOR POSTAGE.**

BARGAIN LIGHT PLANT



1952 Model. 5000 watts. 110/220 volts. 60 cy. AC, one phase, 50 amps. Takes starting overload up to 87 amps. Integrally mounted separate exciter giving exceptional overload and surge capacity for starting motors. Drip-proof constr. Ball bearing, lifetime lubrication. Voltmeter, 2 plug-in receptacles. Wisc. air cooled. 2 cyl. 4 cy. 10½ HP engine.

Special Price Wt. 575 lbs. **$525**

Generator only Wt. 225 lbs. **$325**

BRAND NEW

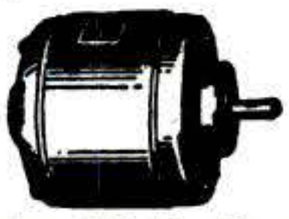
GENERATORS

. . . Big Values

500 to 750 watt, A.C., 110-120 volt, 60 cycle. 1 phase output. Also 100 watt D.C. battery charging output. May be used at the same time. Voltmeter, 2 outlet boxes. Wt. 55 lbs. Price..... **$99.50**

Furnished with 1½ HP Engine with drive **$142.50**

½ H. P. MOTOR

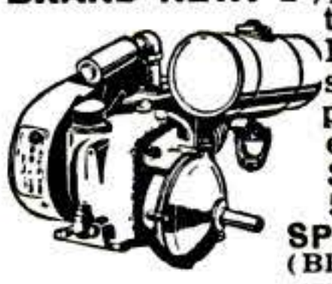


Delco 110-V, 60 cy. A.C., 1 phase 1750 r.p.m. 2 amps., will take 50% overload. Shaft 1⅜ x 1¼. Heavy duty, bronze sleeve bearing. Size 6" long, 5" high. net wt. 12 lbs. List $21.00.

Special $13.50

Lots of 3, ea. $12.50

RED SEAL CONTINENTAL GAS ENGINE

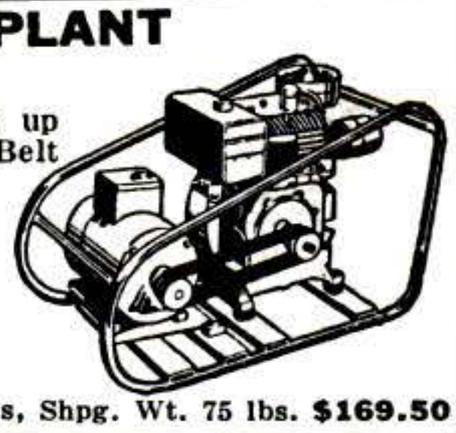


BRAND NEW. 1½ HP with 6 to 1 reduction gear. Operates at 450 R.P.M. For lawn mowers, scooters, garden tractors, pumps, compressors, generators, etc. List Price $79.50. Shipping weight 54 lbs.

SPECIAL PRICE $47.50
(BRAND NEW)

2000-2500 WATT LIGHT PLANT

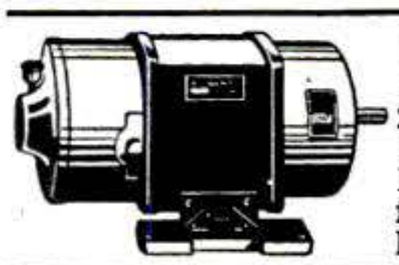
Heavy Duty Windings



110 v., 60 cy., A.C., takes starting overload up to 5000 watts. Floating Base for Automatic Belt Adjusting, 2-Groove Engine Pulleys, V-Belts, Bolts, etc. 5 H.P. Wisconsin or Briggs & Stratton Model 14 Engine. Voltmeter, 2 plug-in receptacles. Portable Tubular Steel Skid Type Carrier. Dim. L 34⅝" x W 17" x H 20". Wt. 180 lbs. **$299.50**

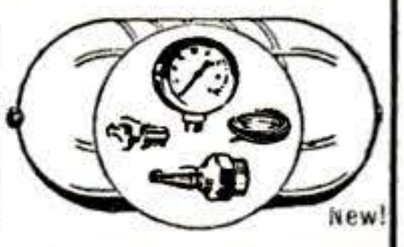
Generator only with voltmeter, 2 plug-in receptacles, Shpg. Wt. 75 lbs. **$169.50**

LELAND GENERATORS



2500 watts, 110 v. 60 cy. single phase 1800 r.p.m., self excited, fungus treated for long life. 1951 model. Brand new, in original factory crate. Shpg. wt. 135 lbs. List $375. Special price.. **$237.50**

AIR TANK AND ACCESSORIES

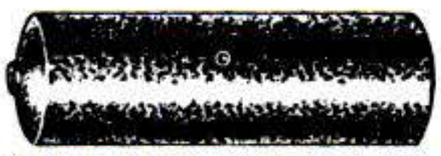


Brand New steel 6"x24", 400 lb. test. Ideal wherever compressed air is needed. Equipped with 500 lb. combination air gauge and inflation valve with core for retaining pressure in tank; tire chuck, 3 ft. high test air hose

Ship. Wt. 12 lbs.
Complete outfit..... **$7.95**

New!

"Wellworth" PRESSURE TANK



7"x25" Welded Steel. ⅜" opening on each end. ¼" and ⅜" opening at centers. Convex Head and Bottom. 100 lbs. working pressure. Shipping wt. 17 lbs..... **$9.75**

Same tank, 9"x27", wt. 28 lbs. **$14.50**

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"It Measures As It Rolls"

ROLLER RULE

HANDY MECHANICAL PENCIL

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Measures Curves and Straight Lines. Any Shape. Any Distance. Any Surface.

Roll head over surface. Inches and fractions record accurately on "Inch-O-Meter". Excellent pencil too! Order Now!
10 Day Money Back Guarantee!
C.O.D. (postage extra). In Calif. add 3% Sales Tax.

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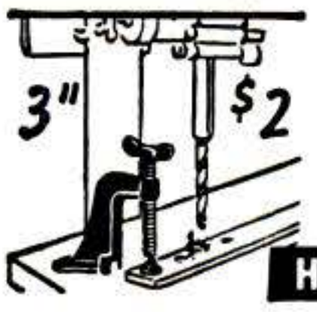
Room 6, 1213 E. Ocean Blvd., Long Beach, California

NEW SURFACE CLAMP

Fastens to Wood or Metal — Assures Better Work — Easier



Today's best hit for Hobbyist or Shop. New SURFACE clamp fastens to either wood or metal, any spot you choose. Patented "under-lock" answers big need. Clamp slides on or off in seconds. Leaves no obstructions when not in use. Swings to any angle, holds vise-like. Not a "C" clamp. New! Different! 3-inch size, $2 postpaid. Guaranteed. Order a pair.

H. E. CASTON, 789 Yale St., Akron 11, Ohio

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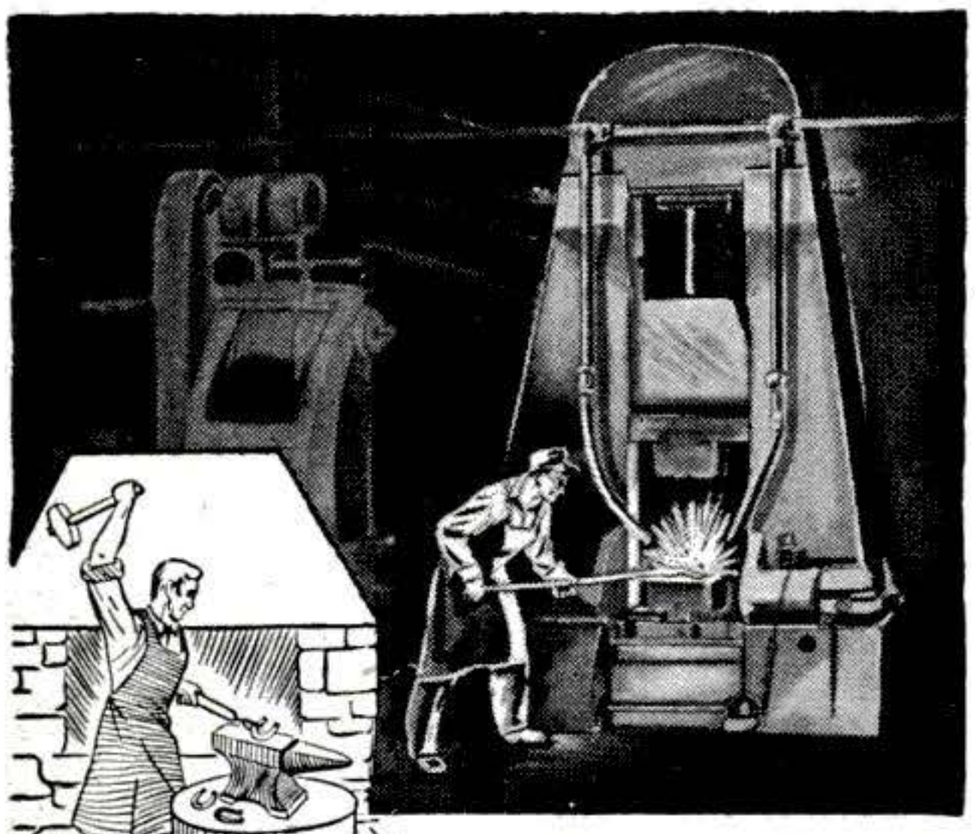
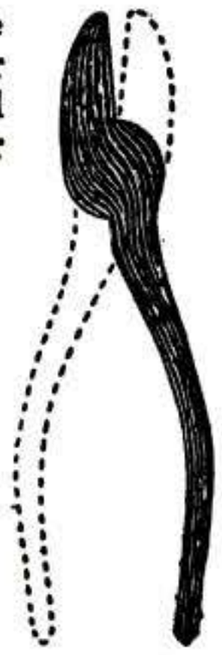


The MODERN BLACKSMITH makes QUALITY tools

The blacksmith of yesterday made horseshoes at his forge because no other method made them so tough and rugged. The sturdy blows of his hammer built stamina into the red-hot metal.

The modern forge principle still builds *super strength* into today's finest tools. Mighty forges at UTICA *align the steel fibre structure* (see diagram at right) of pliers and adjustable wrenches, make them tougher, longer lasting. No other method has ever equalled forging! Remember this when you buy pliers and adjustable wrenches. Look for the name UTICA.



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PAY-OUT HOLD-ON REEL

SURPLUS WINCH

ONLY 32.50

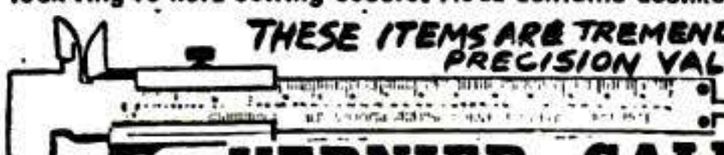
Originally used by the Navy to control gunnery targets when being towed by an airplane. Ideal for many uses. This winch will pay out, hold or reel in cable or rope. It has a capacity for 4500 feet of 3/32" cable or 2500 feet of 1/8" cable. The rotating drum is gear driven and is operated by a crank handle. Drum may be rotated at 1 to 1 or 8 to 3 ratio. A brake holds drum with with ratchet & pawl to set. Size 29"x 13½"x 13"

PRECISION GERMAN MICROMETER

One of the finest quality, imported, precision tools on the market. Reads from .001. It has a ratchet stop for absolute accuracy and a lock ring to hold setting secure. Head contains decimal chart.

9.75 NEW

THESE ITEMS ARE TREMENDOUS PRECISION VALUES...



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VERNIER CALIPER

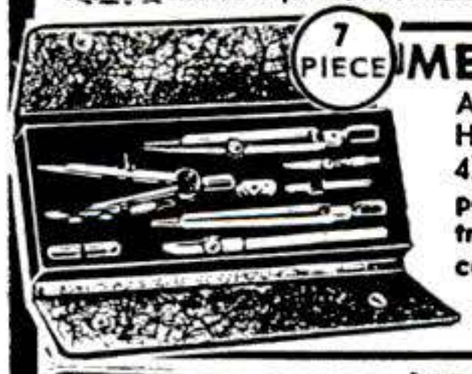
Measures Inside - Outside & Depth from .001 to 6 in. Reads both English & Metric scales. Specially hardened jaws. Sliding jaw has lock nut to hold setting. Made by one of the leading specialists in precision instruments.

9.75 NEW

6 IN. SOLID STEEL STARRET SQUARE

Has specially hardened beams and edges, accurately ground to insure parallelism and straightness. Made of finest quality materials and highly regarded for its use as a standard square. A PALLEY VALUE for ONLY..

13.50 VALUE **8.72** NEW



7 PIECE MECHANICAL DRAWING SET

A REAL PALLEY BARGAIN! Made in Germany. Has a 4½" compass with pen and pencil part; a 4½" divider; one 3½" reverse bow compass for pencil and ink; 4½" ruling pen; capsule with extra lead. Complete in velvet lined case, for only **3.25**

PLASTIC PARALLEL STRAIGHT EDGE

A valuable asset to the navigator, engineer, draftsman or mechanic. Has adjustment knobs. Rubber pads prevent slipping. ONLY **97¢**

A-N – JC-48 HARNESS WIRE

20, 16, 12 GUAGE

Handy for emergency repairs on radios, aircraft, autos, boats, etc. Sold only in bundles of 6 pounds or more. These bundles are in mixed gauges & lengths, very clean & unravelled. This wire normally sells for 4¢ to 5¢ per foot. Here is your opportunity to have a stock of wire in assorted gauges (approx. ½¢ per ft.) 6 lbs. for ONLY **2.95**

CONTINENTAL GAS ENGINE

THAT FAMOUS SINGLE CYLINDER, 4 CYCLE, ENGINE with a GENUINE RED SEAL, Air Cooled 'L' Head. Comes complete with all accessories such as; mesh type air cleaner, flywheel, magneto, float type carburetor, fuel tank, starter pulley, muffler, blower housing, etc. An ideal power plant for small farm machinery, lighting plants, air compressors, power tools, small boats, etc. Weighs only 43 lbs. **49.50**

AMMETERS, D. C. METERS, 'VOLT METERS

–120-0-120+
0-120 . . 0-240
0-300
Any above ammeters. **3.95**

0-30 **4.95**

COMBINATION VOLT–AMMETERS
30 Volt–30 Amp.
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ONLY 4.95

ABOVE AMMETERS HAVE 2" FACE EXCEPT 0-300 WHICH HAS 3" FACE

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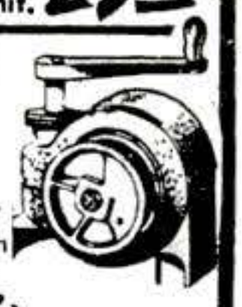
IT IS NECESSARY TO USE SHUNTS WITH ALL D.C. AMMETERS.
120 Amp or 300 Amp.
150 Amp. Each . . **1.25**

WESTINGHOUSE AIR COMPRESSOR

1000's now in use for spraying, inflating, air tools, in garages, laboratories, shops & on trucks, tractors, jeeps, etc. Lightweight but powerful. Operates on ½ HP, gas or electric motor Runs either direction. Delivers approx 3.27 CFM at 600 RPM or 6.54 RPM. at 1200 Rpm. Has 2" bore, 1½" stroke.

We have motors, tanks and fittings to adapt this unit. **23.95**



TINY MITE WINCH HOIST

This mighty little giant lifts up to 1000 lbs with its 30 to 1 Bronze gear drive. Cable drum is 4" x 1¼". Ratchet handle, safety & release pin. Ideal for Boats, Farm, Factory, Shop. ONLY **12.95**

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HYDRAULIC CYLINDER SPECIAL

Gives 20,00 lb. thrust (push-pull) using 1500 PSI line pressure as obtained from our hyd. pumps. Or will produce 40,000 lb. thrust with 3,000 lb. line pressure. Can ALSO BE OPERATED ON LOW PRESSURE AIR SYSTEMS. 4" Bore, 1½" dia. piston shaft, 18" stroke, length: 30½". Equipped with ball bearing loaded clevis type mounting and swivel type high pressure steel pipe bracket for easy use. Ideal for road, farm, & shop machinery, presses, etc. Cost Gov't $390.00. . . . . **29.95**

We carry the World's largest supply of Special Hydraulic Equipment featuring over 20,000 cylinders in 61 sizes and types. Can also supply all accessories such as Pumps, Valves, Tanks, Hose and Fittings. Write for information.

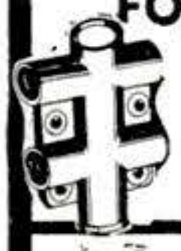
No. 3 HYDRAULIC CYLINDER

Double action. Bore is 1". Shaft is ½". Has a stroke of 2½" to 4". Stroke can be adjusted with internal sleeve stops. Overall length is 8½". Will take 1500 lbs. continuous duty 3000 lbs. intermittent. Will lift or push up to 1100 lbs. **5.75**

No. 9-E HYDRAULIC CYLINDER

Double action cylinder. Has a bore of 1-3/8" and shaft of 1". Stroke is 9". Overall length 15¾". Built for 1500 lbs. continuous duty. 3000 lbs. intermittent. Will lift or push up to 2300 lbs. Can be adapted to hundreds of uses **9.75**

FOUR WAY VALVE

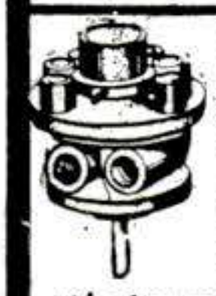


V-9A – – LARGE VOLUME PRESSURE RELIEF VALVE ½" Standard pipe ports. Pressure setting – approx. 1200 PSI. Range – 1000 to 2100 PSI . **5.75**

STRATO-POWER PUMP

With built-in variable flow control valve in head. Positive displacement piston type. Displaces .450 cu. in. per revolution. 2 gal. per min. cap. at 1500 RPM at 1250 PSI. Pressure limit, 1250 PSI continuous, 1400 PSI for 15 sec. Operates at 3750 RPM, intermittent maximum 4500 RPM. Rotates either direction without adjustment **19.50**

GEROTER Type PUMP



Logan Geroter type. For operating hydraulic systems on trucks, tractors, etc. Delivers 8 GPM at 1200 RPM at 1000 PSI with 5 H.P. Can also be used as Hydraulic fluid motor. 3/8" std. pipe ports, 1/2" splined shaft for pulley or direct attachment. 5½" dia., 7". long. Used, but guaranteed condition **19.50**

2 Heat SOLDERING IRON

This is really TWO IRONS in ONE!!! A control button in handle selects 150 or 300 watt heat. Full size iron for light & heavy work. Removable, solid copper tip. Complete with cord and tip **4.95**

200 PAGE CATALOG

1000's of MONEY SAVING Bargains for the Mechanic, Housewife, Manufacturer, Hobbyist, etc. Clothing, Tools, Machinery, Metals, Electrical Supplies, Motors, Rubber, Plastics, Hydraulic supplies (cylinders, pumps, motors, valves, fittings, hose, etc). Send 50¢ to cover mailing & handling.

NOW! MAKE YOUR OWN ARC WELDER!

HERE'S A REAL BUY! Finest, Precision built, R-1 Generators, Originally used on B-29 airplanes. These generators cost the Government approx. $400.00 each. Gives from 300 to 400 amps. at 27 volts. Ideal for all welding, light and heavy, up to 5/8" thickness. Free instructions for converting to welding unit **27.95**

OTHER AIRCRAFT GENERATORS

E-5A . .	12 to 15 Volts	50 Amps.	$12.95
P-1 . . .	27 VOLTS . .	200 AMPS	$15.95
1273-1A .	27 VOLTS . . .	75 AMPS	$15.95
03	27 VOLTS. . .	100 AMPS	$25.00

TORQUE CONVERTER and VARIABLE SPEED UNIT

Consists of a variable speed gear box and a Vickers hydraulic transmission unit (as shown below) An excellent power "booster" and speed controller for conveyor belts, feeder lines, drill presses, power lathes, milling machines, small cars, etc. Converts high RPM, low power input into low RPM, HIGH TORQUE OUTPUT. Maximum output, 6 H.P. Has 2 take-off shafts – one 4 to 1 and one 16 to 1 ratio. Gear box has worm drive, bronze gears & throw out clutch. Forward and reverse drive. Unit can be separated to use variable speed reduction on other equipment. COMPLETE. **59.00**

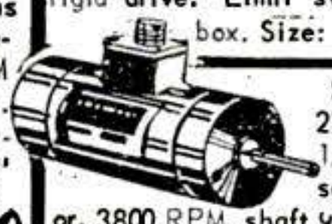
VICKERS HYDRAULIC TRANSMISSION

Self contained, 2 H.P., constant torque at all speeds with variable volume reversible, piston pump (controlled by outside lever) supplying piston hydraulic motor. Automatic pressure, dash pot for smooth control. Power output RPM –0 to 1/3 input RPM in both directions. Input RPM 1800 continuous. 4000 intermittent. Dash pot can be removed for greater RPM. Ideal for lathes, duplicator set-up of mills, conveyors, small cars, drives, gearings, etc. **32.50**

4" SPLINE SHAFTS for input & power take-off . . . **2.50 PR.**

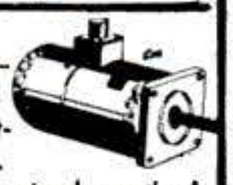
ELECTRIC MOTORS

LEAR ELECTRIC MOTOR. 24 volt, 6 amps, series wound reversible motor . . . with overload clutch. Motor turns 11,000 RPM. Has 11 to 1 gear reduction box turning 1000 RPM at take-off. Adaptable to flex or rigid drive. Limit switch box. Size: 10" x 4" **7.95**



SAMSELL MOTOR 27 volts, 16 amps, 1/5 H.P. reversible, series wound on motor. 3800 RPM, shaft 9/32" diameter. 12-spline. 4-1/8" x 2-3/8" ONLY **3.95**

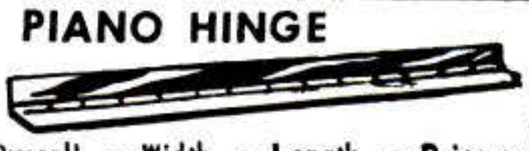
SURPLUS MOTORS



No. 500 – New 1/2 H.P. – 27 Volt, D.C. – A.C. This motor can be readily adapted to deliver up to ½ H.P. on 110 Volts, A.C. by the simple method of rearranging armature brush-leads. Free Diagram with each order. A SENSATIONAL VALUE. **5.95**

No. 500-A – Converted to 110 Volts, A.C. Equipped with plug and 3½ ft. heavy duty cord . . **8.49**

PIANO HINGE



Overall – Width	– Length	– Price ea.
1¼" (5/8" side)	72" alum.	$1.99
3½" (1¼")-	54" st. steel	1.69

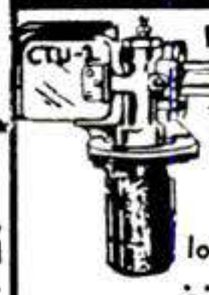
BRASS HINGE - 1¼" (5/8" side) .040 thick) Any length at . . per ft. .29

Attention GADGETEERS

ELECTRIC GYRO

Turns up to 50,000 RPM. Electric drive motor is integral part of balance wheel. Has double end shaft to drive precision tools or machinery at precise, controlled speeds. Full ball bearing mounted. Operates high or low voltage. A highly precise instrument. Ideal for experimental work, science labs, hobbyists & technical engineers. . . . . A TREMENDOUS BUY! **4.95**

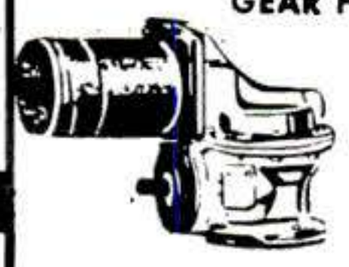
ELECTRIC ACTUATOR



Hundreds of uses for any mechanical device needing controlled 2 way action. Opens, closes, raises or lowers doors . . windows . . . gates . . valves.

CTU-2 Foote linear actuator. 24V. A.C. or D.C., 8500 R.P.M., 1/6 H.P. – Series wound motor. 4½" stroke in 13½ seconds. Compression and tension loads up to 750 pounds. Adjustable micro-switch for limits of travel. Overall length retracted: 11" **6.95**

GEAR HEAD MOTORS



Heavy duty G.E. Gear Head Motor. 1½ H.P., 24 volt D.C., 125 Amp. reversible motor will drive reduction gear box unit 44.5 to 1, resulting in 168 R.P.M. at 5/8" diameter take-off shaft. Motor contains electro magnetic brake

UNIT COMPLETE **10.95** MOTOR **4.95**

GEAR BOX ALONE **7.95**

ELECTRIC TRANSMISSION GEAR TRAIN

GT-1 – approx. 50 Bronze Spur & Pinion Gears, 3/8" to 4" dia., 5 sets of 7 cluster gears, 2 complete worm and worm gear drive sets. 40 N.D. ball bearings ½" to 1½" dia., watch springs bushings, posts, face plates, housings, micro-switches, 2 miniature controlled clutches, etc. Gears in multiple size and sequence, identical teeth ratio, giving 100's of gear reduction combinations. Weight: 19 pounds **8.49**

VALUABLE GEAR BARGAIN

Ideal for revolving radio antenna, television antenna, etc. **6.75**

GEAR BOX VTG-1 – 90° – Bevel gear

1½ to 1 reduction. A lifetime value. Size: 7" x 6" . . **3.95**

Has lever control for engaging and disengaging positive clutch. Dust-proof housing, pre-lubricated bearings . . Can be adapted to Vickers Transmission.

PALLEY'S FAMOUS MIXES! Prepared especially for the HOME CRAFTSMAN, HOBBYIST, INVENTOR, GADGETEER, or SHOP MECHANIC.

GADGET MIX – Rivets, spacers, Bolts, Screws, Gears, Wheel bearings, Springs & Clamps. No. 106, 5 lbs. **1.19**

BEARING MIX–No. 170A. Approx. 20 needle, Ball & Roller Bearings. New & used. Sizes: ½" to 4". Some of these cost Gov't $10 apiece . . . Never such a value . . . 5 lbs. for . . . . . ONLY **1.59**

HINGE MIX–No. 170 H. 12 pairs of strap & butt hinges, hasps, 1" x 1" to 7/8" x 10" in length and 8" strap. 2 lbs. . . **1.09**

ABRASIVE and GRINDING WHEEL MIX – 50 pieces including honing stone, wheels, pencil rolls, etc. . . A sharp value! No. 170AG . . **99¢**

SPRING MIX – No. 206. Torsion, Compression & Tension Springs. Ass't sizes. A treasure trove for emergencies. Scores of springs. 5 lbs. **1.69**

RIVET MIX – 3 POUNDS – Consisting of sizes from 1/4" to 3" long in many diameters and alloys . . **1.19**

FILE MIX – Ten ass't files – 4" to 12". Includes Vixens, half rounds, mills, bastards, etc. in seconds & used but good condition. 1 Vixen alone is worth our price of entire mix . . . . **99¢**

PULLEY MIX – – You'll want this one around. 10 micarta & metal pulleys, ranging from 1" to 5" with ball and one piece bearings. These are aircraft pulleys, the best made, with hundreds of uses **2.95**

SCREW MIX – 5 lbs. including assortment of wood and machine screws. Many sizes. Save dollars & always have plenty of screws on hand . . . **1.39**

NUT MIX – 3 lbs. approx. 500 Nuts, Anchor, Lock, Castle, Hex, Elastic Stop Nuts, etc. You'll always have plenty of nuts in the shop. NM-1 **1.39**

SUPER COMBO MIX – No. SC-2 – Here's a real bargain! ALL 10 ABOVE MIXES for ONLY **12.95**

AIRCRAFT CABLE

Rust resistant, alloyed steel. Extra flexible. Pre-formed, 7 x 19 strand. On reels.

1/16" – 4½¢ ft.	7/32" – 10½¢ ft.
5/64" – 5¢ ft.	1/4" – 12½¢ ft.
3/32" – 5½¢ ft.	9/32" – 15¢ ft.
1/8" – 7¢ ft.	5/16" – 16½¢ ft.
5/32" – 7½¢ ft.	3/8" – 18¢ ft.
3/16" – 9½¢ ft.	1/2" – 20¢ ft.

SPECIAL! 3/16" cable, 18 feet long, with turnbuckle ends. . .99¢

Stainless Steel Cable – Pre-Formed

1/16" – 6¢ ft.	5/32" – 20¢ ft.
3/32" – 14¢ ft.	1/4" – 26¢ ft.

Bronze Cable – Not Pre-Formed

1/16" – 5¢ ft.	3/16" – 23¢ ft.
1/4" – 17¢ ft.	1/2" – 38¢ ft.

Plow Steel Cable Hemp Center 6 x 19
7/8" . . . . 25¢ ft. — 1" . . . . 28¢ ft.

FIRE EXTINGUISHER

Kiddie Lux – CO^2 Type. Built to Gov't specifications. Heavy, shatter-proof case. Recent hydro-static test. Reconditioned and fully charged. LIKE NEW! READY FOR INSTANT USE!!

2 lb. size with Swing Nozzle . .	13.75
3½ lb. size with Swing Nozzle . .	17.95
7½ lb. size with Horn	23.75
10 lb. size with New Squeeze Grip Handle & 3½ ft flex hose with Horn	29.75
15 lb. size with Squeeze Grip hdl, 4ft. flex hose, plastic horn. .	37.95
15 lb. size with Wheel Control . .	42.50

ORDER FROM THIS AD. All sales final. Prices F.O.B. Glendale. Pay by M.O. or Check. P.O.'s accepted from D&B. Firms. ½ deposit with C.O.D's.

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LARGEST FIRM OF ITS TYPE IN THE WORLD

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[Continued from page 100]

chore for Libby who had just finished determining an age of 3,798 years for a charcoal sample from Stonehenge, 6,381 years for a handful of grain from an Egyptian pit, and 11,109 years for a scrap of burned bone from a Paleolithic hearth. For the Isaiah job he selected fragments from the linen wrapping of the scroll.

Geiger Counter Goes to Work

Following the established practice, Libby burned an ounce of this material to the state of pure carbon. This he smeared inside the tube of a Geiger counter. To eliminate interference by current cosmic radiation, the whole apparatus was shielded with thick blocks of steel. Then the radioactivity of the carbon-14 in the tube was carefully counted to arrive at the date when the carbon-14 was created by the action of cosmic rays. In this way we get the answer to the Isaiah riddle:

The Dead Sea scrolls were wrapped in linen which was made from flax that was alive and breathing 1,917 years ago!

Dead Sea Scrolls Are Oldest

Libby, however, cautioned that this answer is not to be accepted as final and exact. The technique of dating gives an exact age—in this instance, 1,917 years—but one must always allow a margin of error, a century or two either way. Ignoring this margin of error, the figure of 1,917 takes us back to the year 34 A.D., approximate date of the Crucifixion.

This dating of the Dead Sea scrolls is of tremendous importance to Bible scholars who, until now, have had no physical evidence to prove that any part of the Bible existed that long ago. They are now reasonably certain that the Book of Isaiah, much as we know it today, was available in the original Hebrew in the time of Christ or shortly thereafter. The oldest known Biblical manuscript heretofore is a fragment of a letter of John, drafted perhaps a century after Christ's time.

There is no such thing as an original manuscript or first edition of the Bible or any of its parts. The Bible is an omnibus of many books written by many authors. Roughly, these books date from about 1000 B.C. to 150 A.D.

Except for fragments, such as the John letter, the oldest versions available when our modern Bibles were prepared have dated back only to the Middle Ages, to about the eighth or ninth century of the Christian era. These were copies or translations of still older manuscripts, dating conceivably to a time more than 10 centuries before Christ, to the time when the Ten Commandments and the Mosaic Code were scrawled on papyrus or parchment and first "published."

Settles 300-Year Debate

The King James version of the Bible, which we read today, was translated from Hebrew, Aramaic and Greek versions by 54 learned men of the Church of England during the years 1604 to 1611. Experts have debated for 300 years over questions of authenticity, quality of source material and accuracy of translation.

Isaiah, for instance, lived in the seventh century B.C. The book of Isaiah, as it appears in our Bible, was translated from a Hebrew version drafted at least 14 centuries after the prophet's time. Thanks to carbon-14 and the Geiger counter, this time lapse has been cut approximately in half, bringing us centuries closer to the lost "first edition." Our confidence in King James's translators gets a sharp lift when we discover that their version checks accurately against the older script.

Did Cave Hold Other Treasures?

But who were the men who stored these scrolls in a desert cave near Ain el Feshkhah? Probably religious leaders of an ancient Jewish sect (the scholars say) who fled from invaders after hiding their religious library in the safest place they could find. Didn't they have anything to hide but scrolls in earthen jars? Isn't it possible they were wise men who sought to store the essence of their knowledge in a natural time capsule where it would be found and appreciated by wiser men, perhaps, in some distant future?

The grim joke is that when the precious cache was found the bulk of it was lost in a few ruthless minutes under the rough feet of ignorant tribesmen, men who live today much as their ancestors lived when the cave at Ain el Feshkhah was sealed 20 centuries ago.

But now that we know such hot and dry caves will preserve parchment through the centuries, there is hope archaeologists may strike such treasure again. **END**

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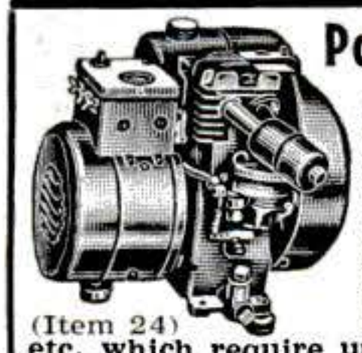
BUY DIRECT - MASTER MECHANIC - UP TO 85% DISC.

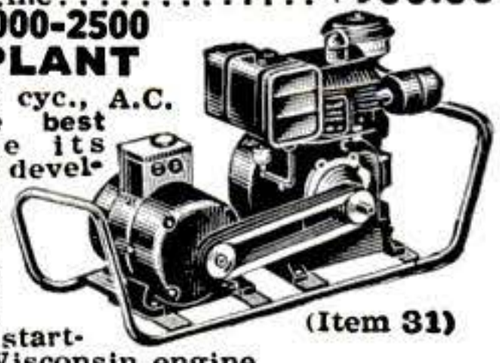


Portable LIGHT PLANT

PUSH BUTTON START

(Item 24) 500-700 watts 110-120 v. — 60 cyc. A.C. Powered by a sturdy dependable, easy starting, air cooled 1¾ hp. gas engine. No wiring necessary, just plug in and operate. Plenty of current for any oil burner, freezer, brooder, pump, emergency lights, etc. which require up to 700 watts. Ideal for Civil Defense, Fire Depts; trailers & camps. Complete with Voltmeter and built-in winding to charge 6 v. auto batteries. Wt. 85 lbs. Fully guaranteed. **Be prepared if war or storm knocks out power lines.**
Reg. $275.00 value..... **$143.50**
1000-1200 Watt Plant (Item 45) same as Item 24, but larger generator & engine..... **$199.50**

GIANT 2000-2500 WATT PLANT



110-120 V. 60 cyc., A.C. **Absolutely the best made** because its heavy windings develop up to 5000 watt overload for motor starting. Skid-mounted—portable. Powered by 5 h. p. easy starting Briggs or Wisconsin engine (Item 31) —complete with all accessories; engine easily disconnected for other uses. Big outlet box, voltmeter, no wiring necessary. Ample current for all purposes. Factory warranty and instructions included. Wt. 220 lbs. Reg. $585.00. Special at.... **$299.50**
With Electric Self Starter (Item 179) **$359.50**
GENERATOR ONLY and control box. Drive it with your engine or tractor **$169.50**

HI-LINE 6000 WATT PLANT (Item 162) Push Button

Start, 115-230 v. 60 cycle A. C. A brute of a power plant with a rugged 13 hp. Wisconsin engine. Plenty of electricity for ranges, water heaters, freezers, pumps, machinery, etc. Affords both 110 and 220 volts. Ideal where heavy current is needed. Wt. 590 lbs. Easily worth $995.00. (with self starter)
Factory special..... **$645.00**
Same plant (with crank start) (Item 166) Wt. 570 lbs. **$585.00**
Generator and control box only, belt driven. Use your engine or tractor. Wt. 240 lbs..... **$345.00**

We Are World's Largest Mail Order Distributors of Light Plants

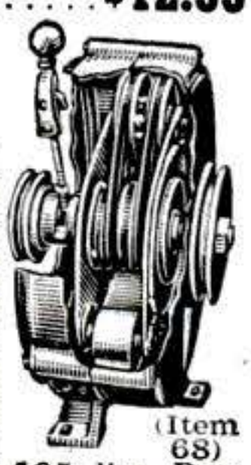
HEATING & VENTILATING FAN

(Item 10) Easily installed in furnace pipes. Forces even heat to all rooms. Over range, removes kitchen smoke and odors. Powerful continuous duty motor, 110-120 V. A.C. Quiet, super efficient fan moves huge volume of air (400 to 600 c.f.m.) 8" Fan, wt. 5 lb. **$6.35;** 9" Fan, wt. 6 lbs. **$7.45;** 10" Fan, wt. [illegible] lb. **$8.45;** 12" Fan, wt. 8 lbs. **$9.45.**

HIGH PRESSURE HAND PUMP

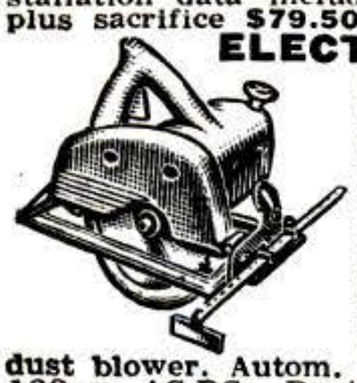
(Item 53) Positive displacement type. Cap. 550 gph. Completely self priming. ¾" pipe thread inlet and outlet. Use for fuel or water transfer on boats, trailers, air craft, etc. Ideal for insecticides, emerg. sump pump or as vacuum pump. Wt. 15 lbs. Govt. cost $95. Our Special..... **$12.95**

VARIABLE SPEED SELECTOR



Heavy duty, made by **B. F. GOODRICH** for industrial use. Provides instant speed changes for any drive. For machine tools, dryers, printing, conveyors, production lines, hoists—any operation requiring variable speed. Ideal for midget autos. Employs reliable "trouble free" planetary system. No hydraulic power losses or creeping. Infinite range, smooth operation, easy installation. 3 sizes: ½-1 hp. wt. 36 lbs; **1-2 hp. wt. 55 lbs.; 2-3 hp. wt.** 105 lbs. Reg. list $228, $252 and $352. Brand new, in Goodrich boxes and guaranteed. Complete installation data included. Unprecedented surplus sacrifice **$79.50, $89.50** and **$114.50.** (Item 68)

ELECTRIC HAND SAW



(Item 36) Most perfectly balanced and smoothest running saw made. Advanced design provides max. power and light weight. Easily adjusted for all angles, depth and width of cut. Comes complete with 6¼" comb. blade, ripping guide and 10 ft. hvy. duty cord. Built-in saw-dust blower. Autom. telescoping guard. 110-120 v. AC-DC. Depth of cut 2¼". 1 year written guar. Wt. 12 lbs.
Drastically reduced..... **$39.95**

IMMEDIATE DELIVERY FOR XMAS

HEAVY DUTY ARC WELDER

(Item 38) Use as portable or shop welder. 250 amps, D.C., Senior model. Made for years of trouble-free, continuous service. Will handle light or heavy jobs. Weld up to ½" plate using ¼" rods. Built-in air-cooling system. Arc is easy to strike and hold, because of specially designed arc stabilizer. Hi-lo switch and dial control gives wide range of welding heats. Run welder at 2600 rpm. with tractor, jeep or 15 hp. gas engine, or 7 hp. elec. motor. Complete with instructions, guar. and double V belt or flat pulley. Wt. 110 lbs.
A $400 value at..... **$99.75**
MAGIC TERMINAL model same as above but with built-in 3rd terminal for low heat soldering and brazing. Special..... **$119.50**
WELDING KIT. Two 10 ft. leads, welding helmet, electrode holder, ground clamp. Sold only with welder at.... **$10.50**

FIRE EXTINGUISHER

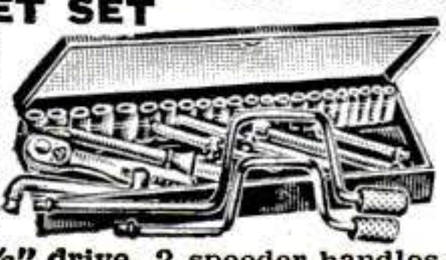
(Item 39) Fully charged (at 1,000 lbs. P. S. I. or more) with CO_2 (carbon dioxide), the proven miracle fire fighting chemical that smothers oil, gasoline and electrical fires. Play safe; keep one in your car, garage and home. Heavy ICC approved steel cylinder, valve and 3000 lb. gauge that shows available remaining pressure. REFILLABLE at nominal cost. Hose included for emergency tire inflator or air blast. Wt. 4 lbs. $19.50 value. Special..... **$6.95**

LARGE FIRE EXTINGUISHER (Item 57) commercial size, 5 x 14 in. (275 cu. in.) heavy ICC approved steel cylinder charged at 1000 lbs. or more with CO_2. Equipped with genuine Kidde Valve. Refillable. Hose incl. Suitable for fire depts., stores, garages, homes, etc. Wt. 18 lbs. $42.50 value. Spec.. **$15.85**

GAUGE TESTER

(Item 27) Precision made of solid bronze and steel by Ashcroft. (Cat. #1300-5). Calibrated weights (incl.) acting against hydraulic piston provides quick accurate testing of all pressure gauges up to 500 psi. Brand new. Wt. 90 lbs. Reg. $318.00. Our Spec..... **$95.00**

34 pc. SOCKET SET



(Item 59) Highest quality guar. non-breakable sockets made by Plomb, Snap On, etc. Complete range of 22 sockets from ¼" thru ¾" in ⅜" drive and 7/16" thru 1-1/16" in **½" drive.** 2 speeder handles, 2 extensions, 2 slide heads, double ⅜ x ½ in. "L" handle, reversible ratchet. Adaptor bit, 2 end wrenches and metal tool box. For professional mechanics who want the best. Wt. 14 lbs. Easily worth $34.50 while they last..... **$16.95**

SPRAY OUTFIT

(Item 37) Twin cyl. piston type compressor direct-connected to powerful 110-120 v. AC-DC motor. Built-in air tank eliminates pulsation and provides steady flow of air at 25-30 lbs. Sprays lacquers, enamels, insecticides, etc. Does beautiful work on autos, furniture, farm equip. 1 qt. spray gun, relief valve and 10 ft. air hose incl. Full instructions and 1 year guar. Wt. 11 lbs. **Regularly** $50. Spec..... **$22.95**

RUBBER HOSE

New genuine Neoprene Hose — outlasts ordinary rubber 3 to 1. Reinforced with super tough cotton cord plies. Flexible. Easy Flo brass couplings with standard pipe threads for quick connections, included. **Pump water for irrigation, stock tanks, home, barn, fire fighting, etc. Pump Gas or Fuel Oil.** Save more than 60%.

(Inside Diam.)	1"	1¼"	1½"
Length	10 ft.	25 ft.	30 ft.
Price	5.95	9.25	14.75

If specified we will send special hose for gas or oil at same prices.

HYDRAULIC HOSE

High pressure, heavy duty, complete with swivel fittings. Pipe thread connections. Ideal for farm equip., bulldozers, grease guns, airbrakes, etc. Any length. Minimum $1 per lgth. INSIDE DIAMETER, ¼" **50¢** per ft. ⅜" **60¢**, ½" **80¢**, ⅝" **90¢**.

Send 10c for a Big War Surplus Catalog. Included Free with Every Order.

EXTENSION CORD

(Item 16) 40 ft. heavy duty, made of specially insulated No. 14 2-conductor wire. So tough that you can drive over it and yet amazingly flexible and easy to handle. Resists oil, grease or water. Extends electricity up to 400 ft. without voltage drop. Use indoors or out. Complete with heavy rubber plug and outlet. Wt. 2½ lbs. Usually $4.50—Special 40 ft. **$1.99**
Comb: 2-40 ft. and 1-20 ft. (total 100 ft.) **$4.95**
100 foot length (one piece)..... **$4.85**
WIRE ONLY (Item 50) No fittings, 100 ft. **$4.00**
TRENCH-LAY WIRE. (Item 51) **Anaconda** #10—2 cond., for buried service to barns, outdoor lights, etc. Absolutely impervious to soil and moisture. Wt. 25 lbs. per 100 ft. Special surplus price. 100 ft. coils, **19¢** per ft.; 250 ft., **18¢** per ft.; 500 ft., **17¢** per ft.

38 Pc. DRILL KIT

(Item 35) Includes hi-power smooth-running guar. ¼" drill, buffers, polishing bonnet, sanding discs, grinding wheels, wood bits, steel bits, wire wheels, bench stand, paint mixer, burrs, Complete in steel case. Wt. 13 lbs. 38 pc's., all highest quality. Complete kit worth $38.50. Our Spec. only... **$19.85**

ACCESSORIES FOR ¼" DRILL

Make complete workshop out of your ¼" drill, using these practical accessories. Quick change—merely insert shaft in drill chuck. Sturdy, heavy duty tools for real work. Precision built of hardened tool steel. Factory guaranteed against breakage.

POWER HACK or JIG SAW

(Item 64) makes straight or curved cuts easily in plywood, ¾" boards, sheet metal, plastics, etc. Uses broken hack saw blades. Will do filing, jig saw, coping saw and sabre saw work. Compares with $50 tools. Wt. 3 lbs. Special... **$16.95**

ELECTRIC HAND SAW

(Item 66) The famous Arco-Saw converts any ¼" or ⅜" drill into a powerful electric saw. Exclusive features—one hand operation, visual guide, bevel and angle adjustments, rip gauge depth gauge. Depth of cut 1-5/16". Self lubricated for life. Wt. 3 lbs. Complete with 4" blade..... **$11.50**

Power Sander & Polisher

(Item 65) Make quick work of slow tedious sanding jobs. Big 21 sq. in. sanding surface. Produces powerful **lengthwise** sanding stroke which results in beautiful smooth finish. Built-in rubber pad. Sandpaper held in place by quick-change spring-clips. No messy adhesives. Use felt pad for polishing. Using drill motor for power gives you equivalent of an $85 sanding machine. Wt. 3 lbs. Terrific value at... **$16.50**

28 pc. BENCH GRINDER KIT

(Item 71) A rugged precision Grinder powered by ¼ hp AC 110 v. 3500 rpm heavy duty motor. Equipped with tool rests and non-breakable safety eye-shields. 28 pc. kit incl. 2 grinding wheels, wire wheel, drill chuck, arbor, asst'd drills. 14 sanding and polishing discs, buffs, etc. All highest quality. 1 year guar. Wt. 17 lbs.
Drastically reduced..... **$21.95**

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(Item 32) Stainless steel tank—capacity 500 cu. in. at 400 lbs. press. complete with inlet and shutoff valves, press. gauge, detachable air hose, tire chuck. Fill at any service station. Carry air for tire inflation, blowing out lines, spray painting, insecticides, etc. One emergency pays back cost. Wt. 10 lbs.
Worth $20.00. Our price..... **$8.95**
(Item 55) With big double tank (1000 cu. in.)..... **$11.95**

POTTERS WHEEL

(Item 47) Complete, prof. equip. for making finest ceramics and pottery. Large dynamically balanced cast-aluminum reversible turntable with variable speed drive (38 to 140 rpm) controlled by foot-pedal. Built-in adjustable arm rests, water cup and wedging wire. 16x12" enclosed throwing table—ample area for largest pieces. Req. ¼ hp. motor (not incl.). Can be set up on 20x24" table and stored on edge. Complete with pulleys, belts and instructions. Wt. 26 lbs.
$145 value at..... **$59.95**

All items *brand new*. Prices f.o.b. Chicago area. 10 day Money back guarantee. Send check or M. O.

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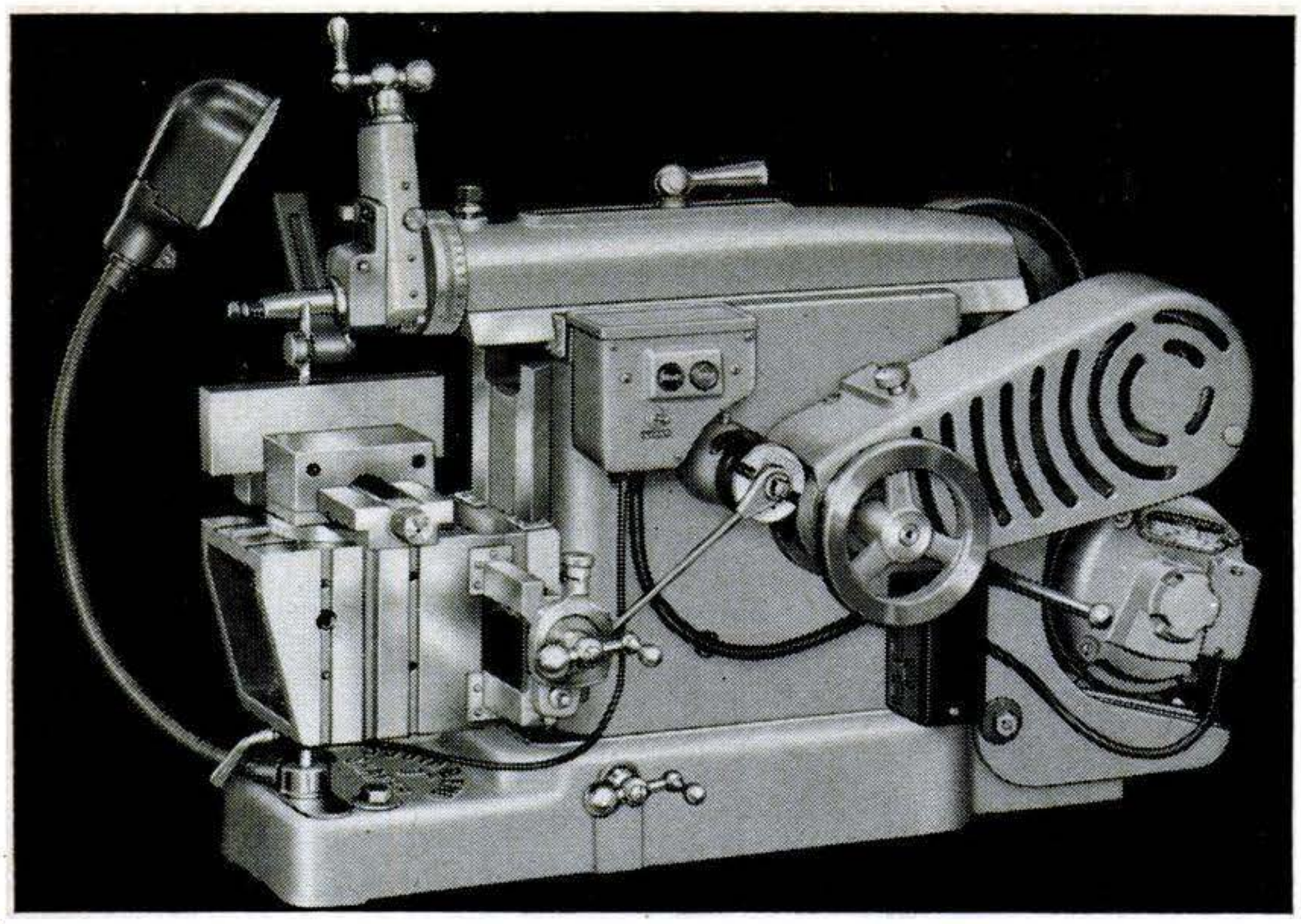
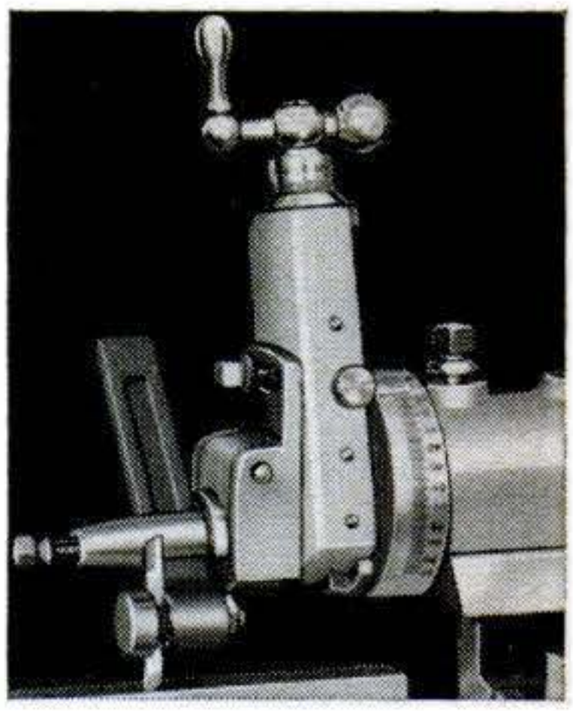
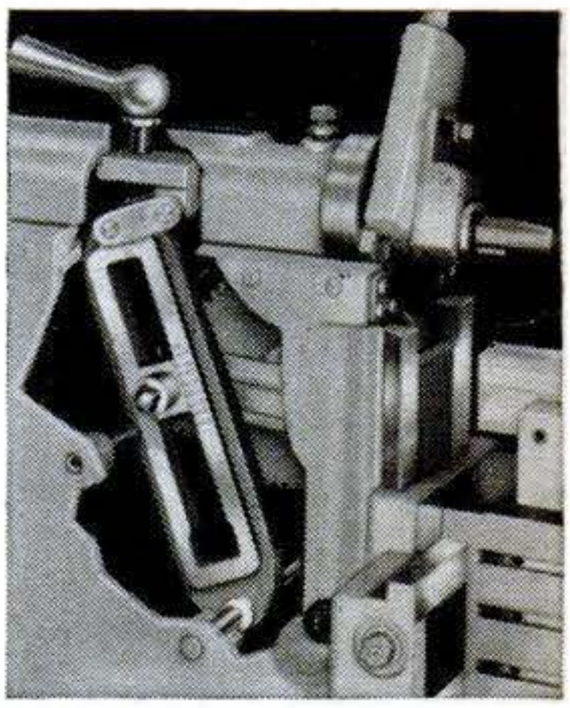
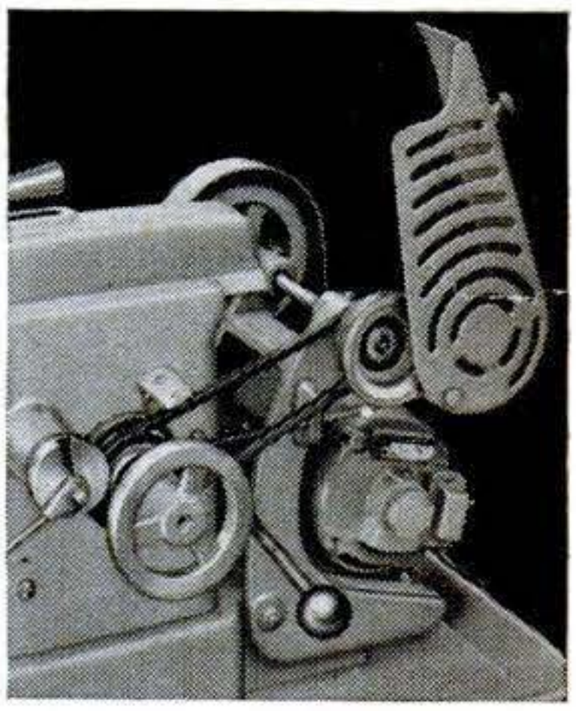




Tool head locks in any position. Rugged clapper box is adjustable.



Rocker and crank with graduated eccentric adjustment for stroke.



Guards on all pulleys and belts. Quick-acting belt tension release.

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7" PRECISION SHAPER

Precision engineered and sturdily constructed, this compact bench shaper has the built-in accuracy and rigidity for rapid machining on small parts. The stroke rate per minute is higher than for larger shapers, permitting greater production on work within its capacity. The ease of setting up work in the bench shaper, its high operating speeds, and low power consumption keep costs at a minimum. A number of practical attachments can be supplied to increase its versatility on toolroom, production, or maintenance work. Check coupon for literature.

SPECIFICATIONS: RAM—Stroke length—0 to 7". Strokes per minute (4)—42 to 195. Cutting speeds—3 to 114 feet per minute.

TOOL HEAD—Vertical feed—3". Swivels—360°. Tool post opening—13/32" x 7/8".

TABLE—Horizontal travel—9 1/2". Vertical travel—5". Power cross feeds (6)—.002 to .012". Ram clearance—1/2 to 5-1/2". Table size—5-3/8 x 5 x 6-5/16".

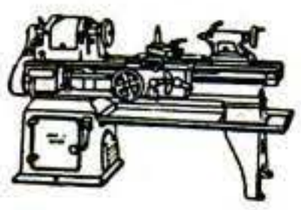
VISE—Jaw width—4". Jaw depth—1". Maximum opening—4". Swivel base.

SEND INFORMATION CHECKED:

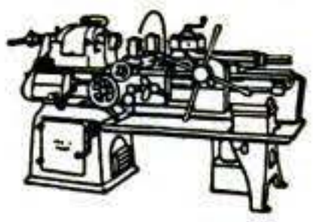
☐ _____

_____

☐ 9" and 10" BENCH LATHES

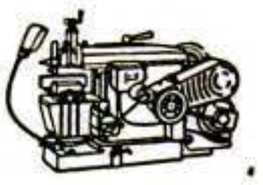


☐ 10" to 16-24" FLOOR LATHES



☐ ½" and 1" Collet TURRET LATHES

☐ 14" DRILL PRESSES



☐ 7" BENCH SHAPERS

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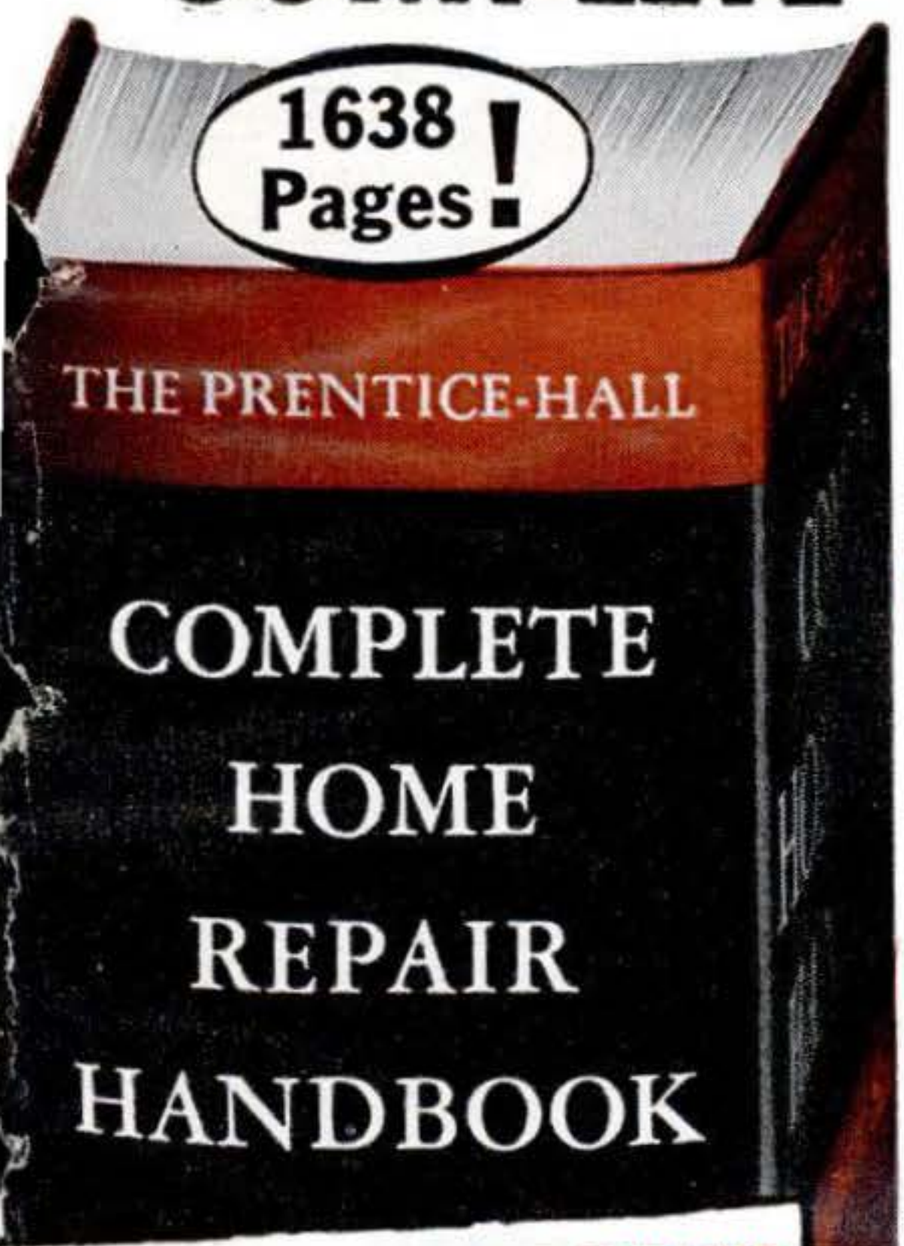

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